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THE IRON TRADE REVIEW

A Weekly Journal Devoted to the Machinery, Metal-Working and Foundry Trades, and Iron and Steel Manufacture.

VOLUME XXXVII CLEVELAND, OHIO, DECEMBER 8, 1904 NUMBER 49

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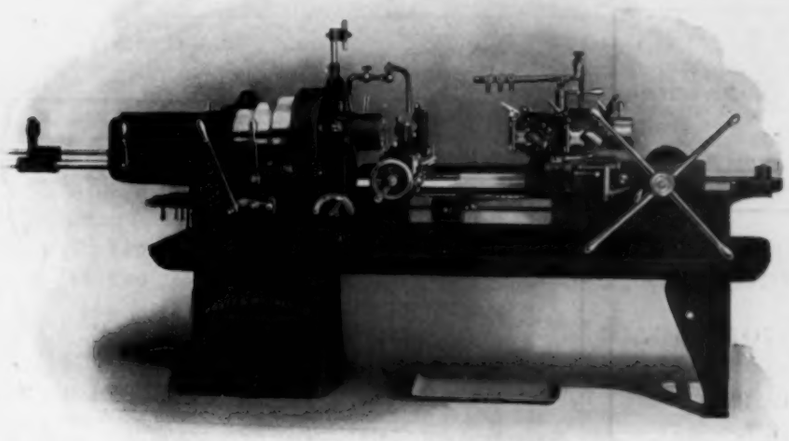
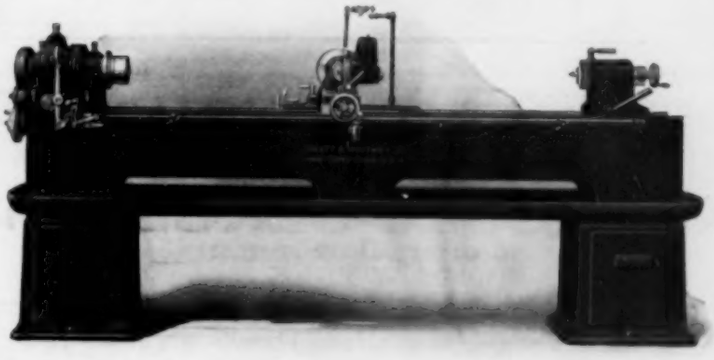
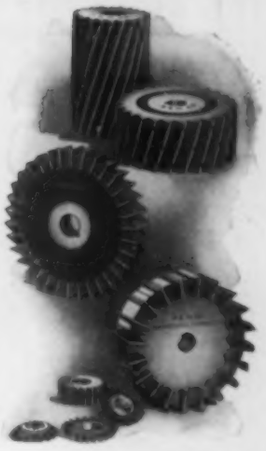


2 x 26 inch New Model Turret Lathe—Five Sizes



6 x 80 inch Thread Milling Machine—Five Sizes



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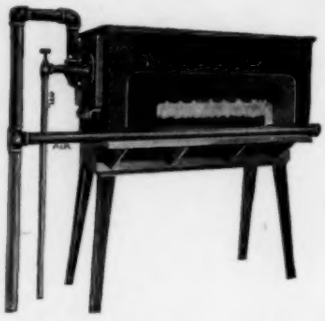

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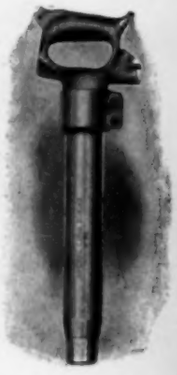


THE IRON TRADE REVIEW

VOLUME XXXVII CLEVELAND, OHIO, DECEMBER 8, 1904 NUMBER 49

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

A week quieter than some immediately preceding it has come upon the iron trade. The lull is more evident in finished materials. In pig iron, while there has been good buying, it has been in particular lines and by no means general. The rank and file of pig iron buyers, being far from clear as to the reasons for the extensive advance made, are waiting for developments in their own lines, in spite of sellers' predictions of higher prices. Increased consumption is evident, but there are indications that consumers are carrying more pig iron in their yards, naturally taking full deliveries in a time of advancing prices. Yet there are still to be noted the urgent calls for deliveries, indicating that with some foundries close connection is being made between the furnace yard and the cupola.

Northern furnaces, selling at 50 cents to $1 a ton below Southern quotations, have done most of the week's business with the general foundry trade. Cast iron pipe manufacturers have been heavy buyers North and South, one sale by Virginia furnaces amounting to 15,000 tons, at $13.50 for No. 3 and $13.25 for No. 4. Virginia furnaces have now gone to $14.50 for No. 2 foundry iron. In the East local furnaces have taken considerable business in foundry and basic and in the West have advanced prices 25 to 50 cents. Alabama furnaces are doing a relatively small business, but being fairly sold for the first quarter of 1905 are not meeting Northern prices; the latter are rather moving up to a parity. At $13.50 furnace only such Alabama iron as is wanted in mixtures is taken. The foundry trade as a rule prefers to await a better demand and a better price for castings before paying $17 to $17.50 for No. 2 iron delivered at a Central Western cupola. In the Chicago market Northern iron has been advanced to $16.50 for No. 2 and one interest is for the time being out of the market. Malleable Bessemer has been marked up to $17 Chicago. The merchant furnaces in the Mahoning and Shenango valleys have the greater part of their output for the first quarter of 1905 sold and are quoting higher prices for the balance. Recent sales, in part to speculators for storage in warrant yards, were made at $15.50 at furnace. Some makers now quote $16, which is also the quotation for No. 2 foundry at certain Central Western furnaces; others are willing to sell No. 2 at $15.50.

The condition of the steel market gives a firm tone to all finished materials. A premium of $1 a ton has been paid for Bessemer sheet bars, and a proposal to advance steel billets will be considered at the association meeting this month. The expectation of an advance in wire products and merchant pipe, referred to in this column last week, was not realized. Demand continues strong in both lines. The price of steel is more directly influencing the sheet market, now that the latter has reached a stronger position. Independent sheet mills that buy their material in the market are not selling for delivery beyond the first of the year. Out of 242 tinplate mills of the leading interest, 202 will be in operation next week, and 63 out of 77 independent mills. Of 163 sheet mills of the same company only 19 are idle, while of 147 independent sheet mills about two-thirds are running.

Structural mills are getting some good business from the railroads and bridge work promises to yield further large contracts in the immediate future. The amount of bridge work now being figured on is reported to be the largest in two years. If expectations as to rail tonnage are realized, the coming year will be one of very large expenditures for railroad renewals. Adjustments with mills other than that at Buffalo continue to delay the formal announcement of the rail price for 1905.

The scrap market has shown good activity at some centers and at others a heavy accumulation of stock by dealers without the expected buying movement among consumers. There has been a long season of activity among dealers, with prices steadily advancing in line with pig iron advances. The real test of dealers' ability to get their price from melters is yet to come.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
429 PARK BUILDING, Dec. 7.

Still further advances in the iron market have been made during the week. The buying was by no means on an extensive scale, but as nearly all the merchant furnaces contiguous to this territory are well sold through the first quarter the prices on the small amount of iron remaining were advanced. No. 2 foundry iron is now established on the basis of $16.85, Pittsburg, while the scarcity of forge iron has resulted in an advance to $15.85. Bessemer iron has sold during the week at $15.40 and $15.60 at the furnace and some operators are asking $16.85, Pittsburg, for first quarter delivery. Basic iron is on the basis of $15.25 to $15.50 at the furnace for future delivery. Little Southern iron is now to be had at $13 Birmingham, most producers asking $13.50, equivalent to $17.85, Pittsburg. At this price Southern iron finds no sale in this market. The report that has found its way into print that the Republic Iron & Steel Co. has purchased the output of three Valley furnaces throughout next year is incorrect. This company secures practically the entire output of the Alice furnace operated by the Youngstown Iron Sheet & Tube Co. on a conversion deal which will continue through next year, while the output of the Claire furnace was purchased early in the year to July, 1905. The output of the Fannie furnace of the Cherry Valley Iron Co. has not been sold to the Repub-

lic Iron & Steel Co. for next year as reported.

The Carnegie Steel Co. continues to increase its iron producing capacity, three idle stacks having come in during the week. Out of a total of 51 stacks this company has four that will no doubt remain inoperative, not being economical producers. Thus out of a total of 47 eligible stacks 44 are now in operation. The Republic Iron & Steel Co. is operating its four furnaces, while the other important independent steel companies, the Jones & Laughlin Steel Co., La Belle Iron Works and the Wheeling Steel & Iron Co. have their stacks going. The pig iron situation is stronger than it has been for many months.

The expected advances in pipe and wire products, referred to last week, were not made, although they are now looked for the first of the year. Specifications for finished products are not as heavy as might be expected, in view of the recent heavy buying, but the manufacturers report that for the season the tonnage is almost up to the average. The sheet and tin plate trades are flourishing. A slight advance has been made in galvanized sheets owing to the constantly advancing spelter market, and higher prices for black sheets are predicted for the first of the year. Out of a total of 242 tin mills the American Sheet & Tin Plate Co. will have 202 in operation next Monday. Out of a total of 77 operative tin mills operated by the independents only 14 are idle. In addition there are 30 independent tin mills, but they are in such shape that they are not in position to take advantage of the present rise. Only 19 of the 163 sheet mills operated by the American Sheet & Tin Plate Co. are idle and orders to place them in operation are expected any day. Of the 147 independent sheet mills about two-thirds are in operation. None of the independent sheet mills are taking business for delivery after the first of the year on the present basis, anticipating an advance in steel at the billet meeting to be held this month. Some of the billet manufacturers are talking of advancing billets to $23, although the more conservative believe that in any event an advance of $1 will be sufficient.

The announcement of rail prices for next year is expected soon. While one of the leading rail producers has been in favor of a slight reduction it is believed that $28 will prevail. The Republic Iron & Steel Co. will be a factor in the rail trade next year. Its rail mill at Youngstown, O., is to be completed in July. It is not probable that it will be operated until October, however, and it is doubtful whether the question of an allotment for the 1905 trade will be considered.

Two local merchant furnace interests have practically secured their ore supply for next year, the ore being purchased on Lake Superior docks.

Pig Iron.—Sales in this market were almost entirely limited to small lots in the past week, although the buying of Bessemer iron for future delivery has been considerable. This iron is being largely purchased by speculators who are placing it in an independent storage warrant yard established at Aliquippa, Pa. Most of this iron, amounting to about 5,000 tons has been purchased on the basis of $15.50, furnace, for delivery during the first quarter. Owing to the refusal of all the Valley furnace interests except one to carry stock in warrant yards at the furnaces the establishment of the yard at Aliquippa became a necessity. The iron for this yard is purchased from the furnaces on the basis of sight draft against bill of lading and the prices secured are considered excellent. A meeting of the Bessemer Pig Iron Association was held in Cleveland on Saturday, Dec. 3. Practically all of the iron of association furnaces through the first quarter has been sold and they are asking higher prices for what remains. For first quarter delivery the market is strong at $15.50 to $15.75 and for the second quarter $16 is asked. Forge iron for early delivery is scarce and is now quoted at $15.85, Pittsburg. The Carnegie Steel Co. blew in Clairton furnace No. 3 last week and two of the Mingo Junction stacks this week. We revise quotations as follows:

Bessemer, Valley	$15 50 to 15 75
Bessemer, Pittsburg	16 35 to 16 60
No. 1 Foundry	17 25 to 17 50
No. 2 Foundry	16 85 to 17 00
Gray-Forge, Pittsburg	15 85 to 16 00
Basic, Valley	15 25 to 15 50
Basic, Pittsburg	16 10 to 16 35

Steel.—A meeting of the billet association has been called to be held in New York on Dec. 20. It will consider a proposal to advance prices $1 or $2 a ton. None of the steel producers will take business on the present basis for delivery beyond the first of the year. We make the following quotations: Bessemer and open-hearth billets, 4 x 4 inches, and slabs, up to and including 0.25 carbon, $21, f. o. b. mill, Pittsburg; with actual freight to points of delivery; 0.26 and including 0.60 carbon, $1 advance, 0.61 to 1.00 carbon $2 advance. Billets smaller than 4 x 4 inches, $2 advance; sheet and tin bars, $23; cut bars, $23.50; forging billets, $23. Bessemer and open-hearth steel rods are held at $27 to $28.

Ferro-Manganese.—A better demand prevails, and domestic ferro is sold at $42 to $43 in carload lots delivered at buyer's mill, any point east of the Mississippi.

Muck Bar.—We note the sale of 500 tons of neutral bars at $27 Youngstown, equivalent to $27.85, Pittsburg.

Skelp.—Demand for skelp continues good and prices are higher. We quote grooved steel at 1.40c to 1.45c and sheared at 1.50c to 1.55c; grooved steel at 1.60c to 1.65c, and sheared at 1.70c to 1.75c.

Rails and Track Material.—An announcement of 1905 rail prices is expected within the coming week. Quotations on light rails have been advanced $1 a ton during the week and still further advances are expected. We revise quotations as follows: Standard sections, 50 lb. and over, in lots of 500 tons and over, $28; car lots and less than 500 tons, $30; less than car lots, $32; light rails, 12 lb., $26; 16 to 25 lb., $23.50 to $24; 25 to 45 lb., $21.50 to $22. Spikes, 1.60c to 1.65c.

Plates.—Steel car specifications are heavy but outside of this line of work there is little doing. We make the following quotations: Tank plates, ¼ in. thick, 6¼ to 24 in., inclusive, 1.30c f. o. b. mill Pittsburg; over 24 in. up to 100 in., 1.40c. Extras are as follows per pound: Flange and boiler steel, 10c; marine, A. B. M. A., and ordinary fire box, 20c; still bottom, 30c; locomotive fire box, 50c; plates over 100 in. up to 110 in width, not less than 5c per 100 lbs. extra; plates 110 in. to 115 in. wide, not less than 10c extra; 115 to 120 in., 15c extra; plates 120 in. to 125 in. wide, not less than 25c extra; plates, 125 in to 130 in., not less than 50c extra; plates 130 in. wide, not less than $1 extra; plates 3-16 in. thick $2 extra; gauges 7 and 8, $3 extra; No. 9, $5 extra. Five cents extra for less than carloads. Terms net cash in 30 days, and for all points of delivery in the United States except the Pacific Coast.

Bars.—Specifications that are being received by the mills are not in proportion with the recent heavy buying; but this is no doubt due to the season and consumers are permitting their stocks to run down for the annual inventory. No further advances have been made in iron bars. We quote: Bar iron, 1.55c to 1.59¼c Pittsburg; hoops, 1.55c, and bands, 1.30c, both taking bar extras. Bessemer steel bars, 1.30c; open-hearth steel bars, 1.35c; plow and cultivator beams, 1.30c, net; channels, angles, zees and tees, under 3 in., 1.40c. The following differentials are maintained on steel: Less than 2,000 lb. of a size and not less than 1,000 lb., 10 cents advance; less than 1,000 lb. of a size, 30 cents advance.

Structural Material.—Contracts for the erection of several mill buildings in this vicinity have been awarded during the week, but no large work is under contemplation. We quote as follows: Beams and channels up to 15 in., 1.40c; over 15 in., 1.50c; angles, 3 x 2 up to 6 x 6, 1.40c; zees, 1.40c; tees, 1.45c; angles, from 3 to 16 in., 1.40c; universal and sheared plates, 6¼ to 24 in., inclusive, 1.30c; over 24 in., 1.40c base.

Sheets.—A slight advance in galvanized sheets has been made by the leading interest on account of the recent advances in the spelter market. The independent mills are not selling on the present basis for delivery next year on account of the probability of an advance in sheet bars. We make the following quotations: Black sheets, one pass, No. 8, 1.75c; No. 9, 1.80c; Nos. 12 to 14, 1.85c; Nos. 15 to 17, 1.90c; Nos. 18 to 21, 1.95c; Nos. 22 to 24, 2c; Nos. 25 to 26, 2.05c; No. 27, 2.10c; No. 28, 2.20c; No. 29, 2.50c; No. 30, 2.60c. Galvanized: Nos. 16 to 17, 2.40c; Nos. 18 to 21, 2.45c; Nos. 22 to 24, 2.60c; Nos. 25 to 26, 2.80c; No. 27, 3c; No. 28, 3.30c; No. 29, 3.60c; No. 30, 4c.

Pipes and Tubes.—Demand continues heavy despite the off season. The expected advance did not materialize, although it is expected that an advance will be made the first of the year. Discounts to consumers, carload lots, f. o. b. Pittsburg, plus freight to destination according to Tube Rate Book, are as follows:

MERCHANT PIPE.

	Steel.		Iron.	
	Black.	Galv.	Black.	Galv.
⅛ and ¼ inch	69	53	67	51
⅜ to 6 inches	77	67	75½	65½
⅛ and ½ inch	73	61	71	59
7 to 12 inches	72	57	70½	55
Extra Strong Plain Ends.				
⅛ to ⅜ inch	63	50	60	48
½ to 4 inches	69	57	67	55
4½ to 8 inches	65	53	63	51
Double extra strong plain ends, ½ to 8 inches	58	47	56	45

MERCHANT BOILER TUBES, LESS CARLOADS, 22 FEET AND UNDER.

	Steel.	Iron.
1 to 1½ inches	46	43
1¾ to 2¼ inches	58	43
2½ inches	60	48
2¾ to 3 inches	66	55
6 to 13 inches	58	43

Wire and Wire Nails.—While jobbers looked for an advance last week none was made and it is probable that nothing will now be done until the first of the year. Demand continues fair in nearly all lines and all the mills are operating at their full capacity. We make the following quotations: Wire nails, jobbers' carload lots, $1.70; retailers' carloads, $1.75, and less than carloads, $1.85; painted barb wire, $1.85 to jobbers in carloads; retailers' carloads, $1.90, and less than carloads, $2, with 30 cents for galvanizing. Annealed smooth fence wire is held at $1.55, with the usual differentials to retailers for carloads and less than carloads. Quotations are all f. o. b. Pittsburg, 60 days, with 2 percent discount for cash in ten days. Iron and cut nails are held at $1.75 and steel $1.70.

Merchant Steel.—A meeting of the shafting association will be held in New York on Dec. 15, but it is doubtful if any price changes will be made. We revise quotations as follows: Toe calk, 2c; carriage spring steel, 1.90c to 2c; tire steel, 1.60c to 1.65c; plow steel, 6 in. and under, 1.35c for Bessemer and open-hearth; plow slabs, ⅓ in. and heavier, 1.60c to 1.65c. Drawn and cold rolled shafting is held at 52 percent off in carload lots and 47 off in less than carload lots.

Old Material.—The market continues quiet, consumers not covering on account of the high prices that are ruling. Dealers will make no concessions and are advancing prices in proportion to the advances in pig iron. We revise quotations, gross tons, as follows: Heavy melting stocks, $14.75 to $15; cast scrap, $13.75 to $14; No. 1 wrought scrap, $15 to $15.25; iron borings, $8.50 to $9; re-rolling rails, $15 to 15.25; sheet scrap, bundled, $12 to $12.25.

Coke.—Foundry coke for delivery through the first half of next year is now $2.50 to $2.75, while a few operators are asking $3. Furnace coke for prompt shipment is held at $2.25, while for delivery through the first half $2.10 to $2.15 is asked. Foundries are buying heavily, while the blast furnace trade is practically covered through the first half. Despite the shortage of water the production of the Connellsville region is increasing. The output during the week ending Nov. 26 was nearly 30,000 tons greater than during the previous week. The number of idle ovens has also been reduced from 7,500 to 5,000. The production of the upper region during that week was 222,286 tons, while the lower region produced 66,328 tons.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1164 MONADNOCK BLOCK, Dec. 6.

The outlook is most promising in all branches of the iron and steel trade. No signs of weakness are apparent and the buoyancy of the market under the first lull that has been felt since the upward movement commenced would indicate little expectation of a slump in prices. All quotations are firm and on some products, notably billets and sheet bars, premiums are being paid for the acceptance of orders. An effort was made last week by a local mill to buy 10,000 tons of Bessemer sheet bars, but only a fifth of this quantity could be bought and for this the consumer paid $27 Chicago. Pig iron is without noteworthy change. The conditions surrounding this product are an enigma to nine-tenths of the foundrymen in this territory. The rapid advances during the past month do not seem warranted to them, when the business in hand or that for the immediate future is taken into consideration. Despite the frequent reports of improved trade conditions, they have not been able to advance their prices for castings, and have bought iron this fall for next year's consumption with considerable reluctance and in the hope there were some hidden conditions warranting present values. Coke shows renewed strength, and standard 72-hour Connellsville is now quoted from $2.50 to $2.75 at the ovens. Trading in scrap is heavier, values being firm at the quotations given elsewhere in this report.

Pig Iron.—Northern furnaces are profiting by the wide spread between their prices and those for Southern irons, and are booking the greater part of the tonnage offered. Since the last 50-cent advance in Southern irons, sales have fallen off considerably, melters preferring to buy Northern iron at a reduction of $1.15 a ton. No heavy movement is expected until local furnaces put up their prices to a par with Southern values, melters naturally viewing with some skepticism a market in which the usual conditions are reversed. One Northern producer has withdrawn from the market, and the other remaining factor has put up his prices to the basis of $16.50 Chicago for No. 2 foundry. There is still some iron being offered at $16.25, and it is doubtless true that a good sized order might bring out a better price than this. Lake Superior charcoal iron is very firm, and an order of several thousand tons went begging last week at $17.25. Malleable Bessemer has also been moved up 50 cents a ton, and is now firm at $17 Chicago. Southern furnaces continue to hold their product at $13.50 Birmingham for No. 2 Foundry, with no evidences of receding from this basis. Higher prices are talked of after the first of the year. Revised prices representing current quotations are as follows:

Lake Superior Charcoal	$17 00 to 17 50
Northern Foundry No. 1	16 75 to 17 00
Northern Foundry No. 2	16 25 to 16 50
Northern Foundry No. 3	16 00
Northern Scotch Foundry	17 50
Ohio Strong Softeners No. 1	17 80 to 18 30
Ohio Strong Softeners No. 2	17 30 to 17 80
Southern Foundry No. 1	17 65
Southern Foundry No. 2	17 15

Southern Foundry No. 3	16 65
Southern Foundry No. 4	16 15
Southern No. 1 Soft	17 65
Southern No. 2 Soft	17 15
Southern Gray Forge	15 90
Southern Mottled	15 90
Southern Silveries (4% to 6% Silicon)	18 15 to 18 65
Jackson Co. Silveries (6% to 8% Silicon)	19 80 to 20 30
Jackson Co. Silveries (8% to 10% Silicon)	20 30 to 20 80
Alabama and Georgia Car Wheel	19 65
Malleable Bessemer	17 00
Basic Iron	17 15

Billets.—Sheet and tin bars and Bessemer billets are very scarce and prices firm. A premium of $1 a ton was paid last week by a local mill on a lot of 2000 tons of Bessemer sheet bars which it bought for delivery in the next two months. There is some demand in this market for forging billets, though it is limited to small lots. We quote prices without change, carload lots, Chicago delivery, as follows: Forging billets, 4 x 4 and larger, up to but not including 10 x 10, $26. Rerolling billets, Bessemer or open hearth, 4 x 4 and larger, up to .25 carbon, $24; up to and including .60 carbon, $1 extra. Billets, 3⅞ in. and smaller, and sheet and tin bars, $26. Wire rods which nominally are quoted $30 Pittsburg, may be shaded about $1 a ton on desirable specifications.

Bars.—Specifications for steel bars show a marked improvement over the tonnage of recent weeks. Some new business has also been taken, although practically every consumer is now under contract. Demand for bar iron is also of good proportions, and mills have no difficulty in maintaining the market at 1.65c Chicago. On small lots, they are now asking $1 a ton above this price. We quote carload lots, Chicago delivery, as follows: Soft steel bars and bands, 1.46½c base, half extras; soft steel angles, less than 3 x 3, 1.56½c; hoops, 1.71½c, full extras. From store, iron bars are quoted 1.80c to 1.90c base, full extras; soft steel angles, channels and tees, 1.80c to 1.90c half extras; hoops, 2c to 2.10c rates full extras.

Sheets.—The local market shows no material change from the condition reported a week ago. Mills are very firm in upholding their prices, and in some cases are asking the maximum quotations given below. Demand for both black and galvanized sheets is of good proportions, and specifications show an improvement. Our prices are without change, and we quote on carload lots, mill shipments, Chicago delivery, as follows: Nos. 9 and 10, 1.76½c to 1.81½c; Nos. 11 and 12, 1.81½c to 1.86½c; Nos. 13 and 14, 1.86½c to 1.91½c; Nos. 15 and 16, 1.96½c to 2.01½c. On box annealed, one pass, cold rolled, we quote Nos. 18 and 20, 2.11½c to 2.16½c; Nos. 22 and 24, 2.16½c to 2.21½c; Nos. 25 and 26, 2.21½c to 2.26½c; No. 27, 2.26½c to 2.31½c; Nos. 28, 2.36½c to 2.41½c; No. 29, 2.46½c to 2.51½c; No. 30, 2.56½c to 2.61½c. Jobbers prices are very firm for lots shipped from stock. As fairly representing the local warehouse trade, we quote as follows: No. 10, 1.95c to 2c; No. 12, 2c to 2.05c; No. 14, 2.05c to 2.10c; No. 16, 2.15c to 2.20c; No. 18, 2.30c to 2.35c; No. 20, 2.35c to 2.40c; No. 22, 2.40c to 2.45c; No. 24, 2.45c to 2.50c; No. 26, 2.50c to 2.55c; No. 27, 2.60c to 2.65c; No. 28, 2.70c to 2.75c; No. 29, 2.80c to 2.85c. Galvanized sheets, mill shipments, Chicago delivery, are quoted as follows: No. 12-14, 2.36½c; No. 16, 2.51½c; No. 18-21, 2.66½c; No. 22-24, 2.81½c; No. 26, 3.01½c; No. 27, 3.21½c; No. 28, 3.41½c. Jobbers' prices on galvanized sheets from store are as follows: Nos. 10 to 16 inclusive, 2.70c to 2.80c; Nos. 18 and 20, 2.80c to 2.90c; Nos. 22 and 24, 3c to 3.10c; No. 26, 3.20 to 3.30c; No. 27, 3.40c to 3.50c; No. 28, 3.60c to 3.70c; No. 29, 4.05c to 4.15c; No. 30, 4.50c to 4.60c.

Structural Steel.—As practically all the large buyers in this market are already under contract, the week's review of this product is limited to the fall and rise in the volume of specifications. These have been of good proportions owing to the open weather which has prevailed. Some new building projects have come to the front, and if half of those now being considered are put into execution with the advent of spring, this city will see the largest consumption of structural steel or the biggest boom in building operations it has experienced since the World's Fair. Prices are without change, and we quote mill shipments, Chicago delivery, as follows: Beams and channels, 3 to 15 in. inclusive, 1.56½c; angles, 3 to 6 in., ¼-in. and heavier, 1.56½c; angles, larger than 6 in. on one or both legs, 1.66½c; beams, larger than 15 in., 1.66½c; zees, 3-in. and over, 1.56c; tees, 3-in. and over, 1.61½c, with the usual extras for cutting to exact lengths, punching, coping, bending or other shop work. Store prices on structural materials according to tonnage are 1.85c to 2c for angles, beams, channels, base sizes, with 1.95c to 2.05c for 18, 20 and 24-in. beams; tees and zees, 1.90c to 2c. These prices are for either random lengths or cut to lengths.

Plates.—Mills report a healthy improvement in the volume of new business as well as in specifications received, and consequently are very sanguine over the outlook. Prices are firm and without change, as follows: Tank steel, ¼-in. and heavier, 24-in. wide, and under, rectangular plates only, 1.46½c base; over 24-in. to 100-in. wide, 1.56½c base; flange steel, 1.66½c base; marine steel, 1.76½c base, all full extras. Plates, 3-16 in. thick, $2 extra; gauges, 7 to 8, $3 extra; No. 9, $5 extra. Less than carload lots, $5 extra. All the local jobbers have advanced their prices on lots from stock, ranging from $1 to $3 a ton, according to the size of the order and delivery required. We have revised our quotations, and now quote as follows: Tank steel, ¼-in. and heavier, 1.85c to 2c; 3-16, 1.95c to 2.05c; No. 8, 1.95c to 2.05c; flange steel, 2.10c to 2.25c.

Rails and Track Supplies.—No announcement as to the price of standard sections in the coming year has yet been made, although it is pretty generally understood the present schedule will be continued. Contracts covering a large tonnage have been made out, and all that is necessary to make them live orders is to fill in the price per ton. Inquiries continue to pour in and a very heavy tonnage is pending. Light rails and track supplies are in brisk demand, and prices have an advancing tendency. We quote as follows: Heavy sections, 500 tons and over, $28; less than 500 tons to carload lots, $30; less than carload lots, $32; second quality rails, $27; light rails, $21 to $23; track supplies, f. o. b. Joliet mill, angle bars, 1.30c; spikes, first quality, 1.60c to 1.65c; track bolts, 3¼ x ¾, with square nuts, 2.25c to 2.30c per 100 lbs; with hexagon nuts, 2.40c to 2.45c.

Merchant Steel.—The principal producers of this product have withdrawn from the market on business for deliveries up to next July, and the market is enlivened only by a good volume of specifications. Prices are without change, and we quote mill shipments, Chicago delivery, as follows: Spring steel, 1.85c; sleigh shoe, flat sizes, 1.51½c; concave and convex, 1.60½c to 1.71½c; cutter shoe, 2.25c; smooth finished machinery steel, 1.71½c; smooth finished tire, 1.66½c; plow steel, 2.20c and upwards, according to quality; toe calk steel, 2.01½c; crucible tool steel, 6½c to 8c; special grades of tool steel, 13c and up; cold rolled shafting, 52 percent from list in carload lots, and 47 percent discount in less than carload lots.

Merchant Pipe.—Business is of good volume, the entire output of the mills of the leading producers going into immediate consumption. The mild weather which has prevailed to date permitting of the continuation of outdoor work, has greatly stimulated specifications. We quote carload lots, mill shipments, random lengths, f. o. b. Chicago, as follows:

MERCHANT PIPE.

	Steel Pipe.		Guaranteed Wrought Iron Pipe.	
	Black. Percent.	Galv. Percent.	Black. Percent.	Galv. Percent.
⅛ and ¼ inches	67.35	51.35	65.85	49.35
⅜ and ½ inches	71.35	59.35	69.35	57.35
¾ to 6 inches	75.35	65.35	73.85	63.85
7 to 12 inches	70.35	55.35	68.85	53.35

Boiler Tubes.—No cessation is to be noted in the demand for tubes, the same improving from day to day. Specifications from jobbers are increasing, indicating a marked improvement in the subsidiary trades. We quote mill shipments, Chicago delivery, as follows:

BOILER TUBES.

	L. W. Steel Percent.	C. C. Iron. Percent.	Seamless Steel. Percent.
1 to 1½ inch	44.35	41.35	52.35
1¼ to 2¼ inch	56.35	41.35	40.35
2½ inch	58.35	46.35	43.35
2¾ inch to 5 inch	64.35	53.35	Up to 4 inches.
6 to 13 inch	56.35	41.35	50.35

The following are the agreed discounts from store:

	Steel.	Iron.	Seamless Steel.
1 to 1½ inches, inclusive	40½	37½	40
1¼ to 2¼ inches, inclusive	50½	35	37½
2½ inches, inclusive	53	37½	40
2¾ to 5 inches, inclusive	60½	47½	47½
6 inches and larger	50½	35	

Cast Iron Pipe.—Two large inquiries have come to the front in the past week—one from Deadwood, S. D., for 800 tons of 14-in. pipe, and the other from Independence, Iowa, for 1600 tons of 4-in. to 16-in. pipe. The general trade is fair, being marked by no sales of importance. We quote carload lots, Chicago delivery, as follows: 4-in. water pipe, $27.50; 6-in. and larger, $25.50; gas pipe, $1 a ton higher.

Wire Products.—It is denied by the leading producer that there is any intention to advance prices of wire products in the immediate future. Demand continues to be of heavy volume, taxing the utmost capacity of mills to meet. We quote prices without change as follows: Carload lots to jobbers, mill shipments, Chicago delivery, wire nails, 1.85c; painted barb wire, 2c; galvanized barb wire, 2.30c; smooth annealed wire, 1.70c; smooth galvanized wire, 2c; polished staples, 1.95c; galvanized staples, 2.25c. Less than carload lots to jobbers are 5 cents higher than above prices. The retail trade is quoted 5 cents extra over the foregoing on carload lots, and 10 cents extra on less than carload lots. Bale ties are unchanged at 82½ and 5 percent to 85 percent discount f. o. b. Waukegan, Ill., on straight carload lots. Poultry netting, 85 and 5 percent discount from list f. o. b. Joliet and DeKalb, with actual freight allowed not exceeding 30 cents per 100 pounds.

Foundry Coke.—Firmness characterizes the local market. No quotations are left open beyond a few days. Demand is increasing, a large number of foundrymen not yet having covered. Standard 72-hour Connellsville is now held on the basis of $2.50 to $2.75 at the ovens, and Wise County (Va.) coke at $2.50 to $2.60 ovens, or $4.75 to $4.85 Chicago.

Old Material.—The local market has more than held its own in the past week. Demand has been heavier and trades more numerous. Our quotations given below are if anything slightly below actual figures asked by dealers. We have revised some of our last week's quotations, and quote dealers' selling prices as follows:

Old steel rails (4 feet and over)	$16 00 to 16 50
Old steel rails (less than 4 feet)	14 50 to 15 00
Old iron rails	22 00 to 22 50
Relaying rails, subject to inspection	21 50 to 22 50
Relaying rails, subject to inspection	19 00 to 20 00
Old wheels	15 00 to 16 00
Heavy melting steel	13 50 to 14 00
Mixed country steel	9 75 to 10 25
Low phosphorus scrap (.05 and under)	13 50 to 14 00

The following quotations are for net tons:

No. 1 R. R. wrought	17 00 to 17 50
No. 2 R. R. wrought	16 00 to 16 50
Shafting	17 00 to 17 50
Dealers' Forge, No. 1	14 00 to 14 50
Wrought pipe and flues	12 50 to 13 00
No. 1 cast, 150 lb. and less	14 00 to 14 50
No. 1 mill	11 00 to 11 50
No. 1 Busheling	12 00 to 12 50
No. 2 Busheling	11 00 to 11 50
Country sheet	8 00 to 8 50
No. 1 boilers, cut	11 50 to 12 00
Boiler punchings	13 00 to 14 00
Iron car axles	21 50 to 22 50
Steel car axles	16 50 to 17 00
Iron axle turnings	11 50 to 12 00
Steel axle turnings	11 50 to 12 00
Cast borings	7 00 to 7 50
Mixed borings, etc	7 00 to 7 50
Machine shop turnings	11 00 to 11 50
Railroad malleable	12 50 to 13 00
Agricultural malleable	12 50 to 13 00
Stove plate and light cast scrap	12 00 to 12 50
Old iron splice bars	18 00 to 18 50

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
1064 ROSE BUILDING, Dec. 7.

Iron Ore.—No more shipments of ore will be made from the head of the lakes, but a few cargoes will be brought from Escanaba. Belated buyers are finding prices higher on some grades, especially on Bessemer, on which the old range quotation is $3.75 to $3.85 and the Mesabi $3.25 to $3.50. Old range non-Bessemers are quoted at $3 to $3.25 and Mesabis at about the same. Although no sales of ore for next year have been reported, there is considerable interest on the part of buyers, who are endeavoring to get information as to what prices will probably be. The question of a general agreement has not received much attention and no one can predict with any certainty whether there will be an association or what prices will prevail, but there is a feeling among ore sellers that, if the price of pig iron is $15 at the stacks, there should be an advance of 50 cents per ton on ore and that if $16 is to be the price of pig iron 75 cents more than this season's quotations should be paid for ore.

Pig Iron.—There has been some diminution in buying, largely because requirements for the first half of 1905 have been covered by many buyers and because furnaces have little to sell for delivery before July 1, 1905. Buyers in many cases are willing to contract for the second half, but sellers are slow to name prices and little business is being done for that delivery. Conservative dealers discourage buying so far into the future. Prices remain about the same as last week, the quotation for No. 2 foundry being $16 at the stacks. A few hundred tons of Southern has been sold at $13.50, Birmingham, for No. 2, and that price has not been shaded. Foundry coke is selling at $2.50 to $2.75 and furnace coke at $2.25 to $2.50. We quote as follows for Cleveland delivery:

Bessemer	$16 35 to 16 60
No. 1 Foundry	16 50 to 17 00
No. 2 Foundry	16 00 to 16 85
No. 3 Foundry	15 50 to 15 75
No. 2 Southern	17 35
Gray Forge	15 25 to 15 50
Gray Forge, Southern	15 50 to 15 85
Lake Superior charcoal	16 50 to 17 00

Finished Material.—Buyers are still anxious to make contracts, but mills are urging the importance of specifying and their sales agents are slow to make contracts. The result is that specifying is heavier in proportion to contracting than it has been and mill conditions are more satisfactory, although in rails, plates and shapes, larger tonnages could be comfortably taken care of. It is asserted that many orders for cars and equipment have recently been taken at less than cost and that conditions in regard to railway equipment are far from being all that might be desired. Bar iron is still quoted at 1.55c to 1.60c at the mills, and some producers say that they can not possibly sell at less than the latter figure, although they admit that they have not taken orders at so high a price. Steel bars are naturally preferred at 1.39½c, Cleveland, for Bessemer and 1.44½c for open-hearth. Sheet business continues good and there are rumors of another advance in the near future. The prices of the principal producers through jobbers are as follows: Cleveland delivery, the freight from Pittsburg being 9½ cents: Mill sales of black sheets in car load lots, No. 10, 1.69½c; No. 11-12, 1.74½; No. 14, 1.79½c; No. 16, 1.89½c; No. 27, 2.24½c; No. 28, 2.34½c.

Galvanized mill sales: No. 14, 2.39½c; No. 16, 2.49½c; No. 18-20, 2.63½c; No. 22-24, 2.79½c; No. 25, 2.99½c; No. 27, 3.19½; No. 28, 3.39½c. Out of stock, black sheets ¼ in., 1.70c; 3-16 in., 1.80c. Blue annealed, No. 10, 2c; No. 12, 2.05c; No. 14, 2.10c; No. 16, 2.20c. One pass cold rolled: No. 18-20, 2.35c; No. 22-24, 2.40c; No. 26, 2.45c; No. 27, 2.50c; No. 28, 2.60c; No. 30, 3c. Galvanized out of stock: No. 16, 2.75c; No. 18-20, 2.85c; No. 22-24, 3c; No. 26, 3.20c; No. 27, 3.40c; No. 28, 3.60c; No. 30, 3.40c.

Old Material.—Demand has been so strong that the tendency of prices upward has not been checked and we have marked up quotations in nearly all kinds of scrap. We quote as follows, gross tons, Cleveland:

Old iron rails	$20 00 to 21 00
Old steel rails (over 6 feet)	15 50 to 16 50
Old steel rails (under 6 feet)	15 00 to 16 00
Old car wheels	14 50 to 15 50
Steel boiler plate	10 00 to 11 00
Steel axles	17 00 to 18 00
Malleable iron (railroad)	15 00 to 15 50
Malleable iron (agricultural)	14 50 to 15 00
Heavy steel	15 00 to 15 50

We quote as follows, net tons:

No. 1 R. R. wrought	17 00 to 17 50
No. 1 busheling	14 50 to 15 00
No. 1 machine cast	14 50 to 15 00
Iron axles	19 00 to 20 00
Axle turnings	12 50 to 13 00
Wrought turnings (free from cast)	10 50 to 11 00
Grate bars	10 00 to 10 50
Pipes and flues	13 00 to 14 00
Tank iron	10 00 to 10 50
Hoop and band iron	8 00 to 9 00
Sheet iron	6 50 to 7 50
Wrought drillings	10 00 to 11 00
Stove plate	11 00 to 11 50
Cast borings	8 00 to 8 50

CINCINNATI.

Dec. 6.

The coke market continues firm and fairly active. Furnace coke for prompt shipment is in light supply with prices ranging from $2.35 to $2.50 f. o. b. ovens. Six months contracts are taken at $2.15 to $2.25 f. o. b. ovens. Foundry coke is quoted at $2.50 to $2.65 f. o. b. Connellsville.

Pig Iron.—While the buying has not been so large as in the preceding week, still there is a fairly good demand and quite a number of orders widely distributed. An Ohio manufacturer bought during the week 3,500 tons of malleable iron at prices ranging from $15 to $15.25 at Ohio furnaces. This is the only important sale as to tonnage reported. The general quotation on Southern iron is $13.50 for No. 2 Foundry Birmingham, but there is still some iron obtainable at $13 Birmingham. Sales during the week have been made within the range of the above prices. Ohio furnaces have advanced their quotations and we hear of nothing now offered under $15.50 for No. 2 foundry and some of the Northern interests are asking $16. Buyers continue to assert that the advance is not justified by increased consumption or higher prices for foundry product. Nevertheless, the situation at the furnaces and the volume of buying, together with the fact that prices still show an advancing tendency make sellers firm in their views. As was expected there is some difficulty experienced in getting coke shipments forward through lack of railroad facilities and by reason of car congestions. The difficulties attending the increase of production of pig iron by getting furnaces into blast still obtain and we hear of only one furnace going in during the week and another furnace which expects to start in February. The feeling in the trade is decidedly strong under the belief that the entire iron industry is entering upon an active period, as indicated by reports of railroad buying, activity in car shops and other encouraging features. We quote f. o. b. Cincinnati as follows:

Southern Foundry No. 1	$16 25 to 16 75
Southern Foundry No. 2	15 75 to 16 25
Southern Foundry No. 3	15 25 to 15 75
Southern Foundry No. 4	15 00 to 15 25
Southern Foundry No. 1, soft	16 25 to 16 75
Southern Foundry No. 2, soft	15 75 to 16 25
Gray forge	14 75 to 15 00
Northern Foundry No. 1	17 15 to 17 65
Northern Foundry No. 2	16 65 to 17 15
Southern Charcoal	18 75 to 19 00

Finished Material.—The activity in bar iron still continues and the market is strong. It is reported that an Ohio concern bought 3,000 tons of bar iron during the week at 1.65c at destination, deliveries commencing at once and extending into the next three months. Other descriptions show increasing activity and buyers are placing orders for more liberal quantities, which is an evidence of less conservatism and hesitancy. Bar iron is now quoted at 1.60c; steel bars at 1.43c, half extras, with dealers quoting 1.75c for iron and steel out of store. Galvanized sheets at 75 and 10 and 5 percent off. We quote black sheets, No. 27, at 2.40c in car lots of 500 bundles. Black sheets out of store are selling as follows: No. 28, 2.70c; No. 27, 2.60c; No. 16, 2.20c; No. 14, 2.10c; No. 12, 2.05c; No. 10, 2c. Tank plates are dull and sell out of store at 1.85c for ¼-in. and 1.95c for 3-16-in. No. 8 and No. 10. Beams and channels are quoted at 1.85c from stock, and angles at 1.85c to 1.90c for base sizes.

The merchant pipe situation has not changed. The demand continues fairly good and reports indicate that independent mills are quoting prices closer to the schedule of the leading interests. Trouble in getting mill orders forward owing to railroad congestion is still a feature. Car load lots are quoted as follows f. o. b. Cincinnati:

MERCHANT PIPE.
(Basing Discounts.)

	Steel Pipe.		Guaranteed Wrought Iron Pipe.	
	Black. Percent.	Galv. Percent.	Black. Percent.	Galv. Percent.
⅛ and ¼ inches	67.35	51.35	65.35	49.35
⅜ and ½ inches	71.35	59.35	69.35	57.35
¾ to 6 inches	75.35	65.35	73.85	63.85
7 to 12 inches	70.35	55.35	68.85	53.35

Old Material.—Everything on the list continues to be firmly held with sellers holding some descriptions above the market. There is a good inquiry but dealers find it difficult to bring out offerings. Quotations f. o. b. Cincinnati are as follows:

Old No. 1 railroad wrought, net tons	$14 50 to 15 00
Cast machine and foundry, net tons	12 50 to 13 00
Old iron rails, gross tons	18 00 to 18 50
Old steel rails, gross tons	13 50 to 14 00
Old short lengths, gross tons	13 50 to 14 00
Old iron axles, net tons	17 50 to 18 00
Stove plate, net tons	9 50 to 10 00
Wrought turnings, net tons	10 00 to 10 50
Cast borings, net tons	6 50 to 7 00

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1315, No. 150 NASSAU ST., Dec. 6.

Pig Iron.—Contrary to expectations the opening week of December was marked by considerable activity, the tonnage placed being conservatively estimated at 25,000 tons, about equally divided between foundry and basic. The business was almost entirely taken by Northern furnaces, and as a result all Northern brands are a little higher than a week ago. Northern No. 2 foundry sold during the week as high as $16.50 at the furnace, but most of the sales made were at from $16 to $16.25, with the latter figure most in evidence. In Southern irons very few sales have been made in this vicinity, with prices ruling strong at $13.50 Birmingham for No. 2 foundry. Most of the tonnage placed during the week has been for delivery the first quarter of the new year. While prices at seaboard points for imported iron have been very near domestic quotations, no sales for import have been made as yet. Representatives here of English furnaces say they have received many inquiries in the matter, one being for 10,000 tons. They say that Middlesbrough No. 3 could not be delivered at seaboard points at the present time for less than $17.50. They are positive that imports will be contracted for in a few weeks. As for the domestic situation in general, gossip as to the immediate future of the market

is very hopeful. Many are unwilling to express opinions as to the future course of prices, until more is known than now as to the extent recent purchases represent provision for actual requirements. It is said that there is scarcely a consuming interest that has not purchased iron to the extent of at least 25 percent in excess of what orders on hand or in prospect will require. New York quotations at tidewater follow: Northern No. 1 foundry, $17.25 to $17.50; No. 2 foundry, $17.00 to $17.25; No. 2 plain, $16.50 to $16.75; No. 1 Southern, $17.50 to $17.75; No. 2 Southern, $17 to $17.25; No. 3 foundry, $16.50 to $16.75; No. 4 foundry, $16 to $16.25.

Rails.—No meeting of the pool has been held during the week, and none is scheduled for the immediate future, according to reliable authority. As the allotment situation stands now, there is nothing in the way of the price for next year being fixed, and that it will be $28 at mill seems a certainty.

Finished Iron and Steel.—There were no sales of any consequence made in structural shapes during the week, but business in sight, which is likely to go to the leading interest, including a warehouse at Cincinnati calling for 3,500 tons, an addition to a dry goods store in Chicago requiring 3,500 tons, and an office building in San Francisco, calling for from 1,000 to 2,000 tons. The Boston Elevated contract for over 10,000 tons is still unplaced. Railroads have specifications out that call for from 40,000 to 50,000 tons, but final orders may not reach that figure. An advance in structural shapes is looked for this month, with some talking 1.60c base. In plates, bars, and sheets new business closed during the week was very good, and advances in all of them is talked of. New York prices at tidewater follow: Angles, 3 to 6 in. x ¼ in. and heavier, 1.54½c; beams, 3 to 15 in., 1.54½c; channels, 3 to 15 in., 1.54½c; beams, 18, 20 and 24 in., 1.64½c; tees, 3 x ¼ in. and heavier, 1.59¼c; plates, carloads, tank, 1.54½c; flange, 1.64½c; marine and ordinary fire box, 1.74½c; refined iron bars, 1.54½c; soft steel bars, 1.44½c; sheets, in carload lots, New York, No. 28, black, 2.40 to 2.45c; galvanized, 3.40 to 3.50c.

Old Material.—The feature of the week has been the heavy purchases of scrap material, at least 25,000 tons having changed hands. There continues to be an excellent demand for everything on the list, with prices continuing irregular, but with an upward trend. Holders still show an unwillingness to sell, being more convinced than ever that prices are going still higher. We quote f. o. b. cars:

Old iron rails	$16 00 to 17 00
Old steel rails, long lengths	15 00 to 15 50
Old steel rails, short pieces	14 50 to 15 00
Relaying rails	19 00 to 20 00
Old car wheels	14 00 to 14 50
Old iron car axles	19 00 to 20 00
Old steel car axles	16 00 to 17 00
Heavy melting steel scrap	15 00 to 15 50
No. 1 railroad wrought scrap	17 00 to 18 00
Iron track scrap	15 00 to 16 00
Wrought pipe	10 00 to 11 00
Ordinary light iron	10 00 to 11 00
Cast borings	6 00 to 7 00
Wrought turnings	8.50 to 9 50
No. 1 machinery cast	12 00 to 12 75
Stove plate	9 50 to 10 00

PHILADELPHIA.

Dec. 6.

There is less activity in this market at present, a condition which naturally follows the heavy buying movement of November. Arrangements are being made to blow in a number of furnaces and the production will be considerably increased this month. Hence higher prices of pig iron are not expected. Specifications on finished products have not kept pace with the buying. Those who have had long experience are disposed to be conservative.

Pig Iron.—Sellers have taken orders to such a large extent recently that they are not willing to make contracts extending into next year. If prices are to be advanced, they want to get the benefit. Mill irons are very strong and command $15.75 to $16, delivered. Basic is also in strong demand. Foundries are said to be carrying pretty good supplies and pressure for deliveries is not expected to be strong. Scarcity of coke is a factor to be considered. We quote as follows, Philadelphia delivery: No. 1X Foundry, $17.25 to $17.50; No. 2X Foundry, $16.50 to $17; No. 2X Plain, $16 to $16.25; gray forge, $15.75 to $16; basic, $15.50 to $15.75.

Finished Material.—Demand is less active, but business cannot be described as dull. Buyers placed orders freely in anticipation of higher prices. Mills are well supplied with work. We quote: Plates, 1.43½ to 1.48c; beams, channels and angles, 1.53½ to 1.65c, according to specifications, and small angles, 1.50c to 1.55c. Bar iron is quoted 1.53½c for carload lots and over; steel bars, 1.43½c.

BIRMINGHAM.

BIRMINGHAM, ALA., Dec. 5.—Alabama pig iron quotations have advanced at some furnaces and No. 2 is now being sold at $13.75 against $13.50 last week. It is learned that several thousand tons of iron have been sold at the new price. The inquiry is steady, some of the would-be purchasers asking about iron for delivery during the last half of the coming year. The local consumption is quite heavy. Cast iron pipe foundries, car wheel works, foundries and machine shops and rolling mills are requiring much iron for their operation. The steel plants are taking up all the iron from six furnaces, the steel plant of the Tennessee Coal, Iron & Railroad Co. requiring the iron made at the five Ensley furnaces. The Ensley steel plant during the month of November turned out 21,487 tons of ingots while the blast furnaces they produced 28,100 tons of basic iron..

The production of iron in the Birmingham district is still not what it should be. The strike of the union coal miners, now in its sixth month, is still felt. The leaders of the miners assert that to yield means the disintegration of the union; in other words, that the companies will not further recognize the union. All miners, union and non-union, have been granted a five cent per ton increase for the month of December.

Iron shipments have been greater than the production in this district for some weeks now. Large sales have been made for the first three months of the coming year, and these indicate that every ton that can be manufactured will be required. The stock of iron in this district has dwindled down considerably and is now estimated under 40,000 tons. Companies carrying the greater portion of this surplus do not appear to be anxious to rush into the market even at the prices prevailing, intimating that $14 iron will be seen this week, while $15 iron is predicted for this month. Conditions were never before brighter, if only the production was better.

The following quotations are made by sellers: No. 1 foundry, $14 to $14.25; No. 2 foundry, $13.50 to $13.75; No. 3 foundry, $12.75 to $13; No. 4 foundry, $12 to $12.50; gray forge, $11.50 to $12; No. 1 soft, $13.75 to $14.25; No. 2 soft, $13.50 to $13.75.

The Metal Market.

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1315, NO. 150 NASSAU ST., Dec. 6.

Pig Tin.—Following the publication of the monthly statistics, compiled by Secretary C. Mayer of the local Metal Exchange, which show an increase of 2,218 tons in the total visible supply, the market has been very weak, declines being from ½ to ¾ cents over last week's quotations. The statistics showed that the total visible supply on Nov. 30, was 14,412 tons, against 12,194 tons for October, and that the arrivals for the month were 2,204 tons, against 2,925 tons for October. In London the market has been very heavy, and prices are from £2 to £3 lower than a week ago. Closing prices today follows:

Galvanized mill sales: No. 14, 2.39½c; No. 16, 2.49½c; No. 18-20, 2.63½c; No. 22-24, 2.79½c; No. 25, 2.99½c; No. 27, 3.19½; No. 28, 3.39½c. Out of stock, black sheets ¼ in., 1.70c; 3-16 in., 1.80c. Blue annealed, No. 10, 2c; No. 12, 2.05c; No. 14, 2.10c; No. 16, 2.20c. One pass cold rolled: No. 18-20, 2.35c; No. 22-24, 2.40c; No. 26, 2.45c; No. 27, 2.50c; No. 28, 2.60c; No. 30, 3c. Galvanized out of stock: No. 16, 2.75c; No. 18-20, 2.85c; No. 22-24, 3c; No. 26, 3.20c; No. 27, 3.40c; No. 28, 3.60c; No. 30, 3.40c.

Old Material.—Demand has been so strong that the tendency of prices upward has not been checked and we have marked up quotations in nearly all kinds of scrap. We quote as follows, gross tons, Cleveland:

Old iron rails	$20 00 to 21 00
Old steel rails (over 6 feet)	15 50 to 16 50
Old steel rails (under 6 feet)	15 00 to 16 00
Old car wheels	14 50 to 15 50
Steel boiler plate	10 00 to 11 00
Steel axles	17 00 to 18 00
Malleable iron (railroad)	15 00 to 15 50
Malleable iron (agricultural)	14 50 to 15 00
Heavy steel	15 00 to 15 50

We quote as follows, net tons:

No. 1 R. R. wrought	17 00 to 17 50
No. 1 busheling	14 50 to 15 00
No. 1 machine cast	14 50 to 15 00
Iron axles	19 00 to 20 00
Axle turnings	12 50 to 13 00
Wrought turnings (free from cast)	10 50 to 11 00
Grate bars	10 00 to 10 50
Pipes and flues	13 00 to 14 00
Tank iron	10 00 to 10 50
Hoop and band iron	8 00 to 9 00
Sheet iron	6 50 to 7 50
Wrought drillings	10 00 to 11 00
Stove plate	11 00 to 11 50
Cast borings	8 00 to 8 50

CINCINNATI.

Dec. 6.

The coke market continues firm and fairly active. Furnace coke for prompt shipment is in light supply with prices ranging from $2.35 to $2.50 f. o. b. ovens. Six months contracts are taken at $2.15 to $2.25 f. o. b. ovens. Foundry coke is quoted at $2.50 to $2.65 f. o. b. Connellsville.

Pig Iron.—While the buying has not been so large as in the preceding week, still there is a fairly good demand and quite a number of orders widely distributed. An Ohio manufacturer bought during the week 3,500 tons of malleable iron at prices ranging from $15 to $15.25 at Ohio furnaces. This is the only important sale as to tonnage reported. The general quotation on Southern iron is $13.50 for No. 2 Foundry Birmingham, but there is still some iron obtainable at $13 Birmingham. Sales during the week have been made within the range of the above prices. Ohio furnaces have advanced their quotations and we hear of nothing now offered under $15.50 for No. 2 foundry and some of the Northern interests are asking $16. Buyers continue to assert that the advance is not justified by increased consumption or higher prices for foundry product. Nevertheless, the situation at the furnaces and the volume of buying, together with the fact that prices still show an advancing tendency make sellers firm in their views. As was expected there is some difficulty experienced in getting coke shipments forward through lack of railroad facilities and by reason of car congestions. The difficulties attending the increase of production of pig iron by getting furnaces into blast still obtain and we hear of only one furnace going in during the week and another furnace which expects to start in February. The feeling in the trade is decidedly strong under the belief that the entire iron industry is entering upon an active period, as indicated by reports of railroad buying, activity in car shops and other encouraging features. We quote f. o. b. Cincinnati as follows:

Southern Foundry No. 1	$16 25 to 16 75
Southern Foundry No. 2	15 75 to 16 25
Southern Foundry No. 3	15 25 to 15 75
Southern Foundry No. 4	15 00 to 15 25
Southern Foundry No. 1, soft	16 25 to 16 75
Southern Foundry No. 2, soft	15 75 to 16 25
Gray forge	14 75 to 15 00
Northern Foundry No. 1	17 15 to 17 65
Northern Foundry No. 2	16 65 to 17 15
Southern Charcoal	18 75 to 19 00

Finished Material.—The activity in bar iron still continues and the market is strong. It is reported that an Ohio concern bought 3,000 tons of bar iron during the week at 1.65c at destination, deliveries commencing at once and extending into the next three months. Other descriptions show increasing activity and buyers are placing orders for more liberal quantities, which is an evidence of less conservatism and hesitancy. Bar iron is now quoted at 1.60c; steel bars at 1.43c, half extras, with dealers quoting 1.75c for iron and steel out of store. Galvanized sheets at 75 and 10 and 5 percent off. We quote black sheets, No. 27, at 2.40c in car lots of 500 bundles. Black sheets out of store are selling as follows: No. 28, 2.70c; No. 27, 2.60c; No. 16, 2.20c; No. 14, 2.10c; No. 12, 2.05c; No. 10, 2c. Tank plates are dull and sell out of store at 1.85c for ¼-in. and 1.95c for 3-16-in. No. 8 and No. 10. Beams and channels are quoted at 1.85c from stock, and angles at 1.85c to 1.90c for base sizes.

The merchant pipe situation has not changed. The demand continues fairly good and reports indicate that independent mills are quoting prices closer to the schedule of the leading interests. Trouble in getting mill orders forward owing to railroad congestion is still a feature. Car load lots are quoted as follows f. o. b. Cincinnati:

MERCHANT PIPE.
(Basing Discounts.)

	Steel Pipe.		Guaranteed Wrought Iron Pipe.	
	Black. Percent.	Galv. Percent.	Black. Percent.	Galv. Percent.
⅛ and ¼ inches	67.35	51.35	65.35	49.35
⅜ and ½ inches	71.35	59.35	69.35	57.35
¾ to 6 inches	75.35	65.35	73.85	63.85
7 to 12 inches	70.35	55.35	68.85	53.35

Old Material.—Everything on the list continues to be firmly held with sellers holding some descriptions above the market. There is a good inquiry but dealers find it difficult to bring out offerings. Quotations f. o. b. Cincinnati are as follows:

Old No. 1 railroad wrought, net tons	$14 50 to 15 00
Cast machine and foundry, net tons	12 50 to 13 00
Old iron rails, gross tons	18 00 to 18 50
Old steel rails, gross tons	13 50 to 14 00
Old short lengths, gross tons	13 50 to 14 00
Old iron axles, net tons	17 50 to 18 00
Stove plate, net tons	9 50 to 10 00
Wrought turnings, net tons	10 00 to 10 50
Cast borings, net tons	6 50 to 7 00

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1315, NO. 150 NASSAU ST., Dec. 6.

Pig Iron.—Contrary to expectations the opening week of December was marked by considerable activity, the tonnage placed being conservatively estimated at 25,000 tons, about equally divided between foundry and basic. The business was almost entirely taken by Northern furnaces, and as a result all Northern brands are a little higher than a week ago. Northern No. 2 foundry sold during the week as high as $16.50 at the furnace, but most of the sales made were at from $16 to $16.25, with the latter figure most in evidence. In Southern irons very few sales have been made in this vicinity, with prices ruling strong at $13.50 Birmingham for No. 2 foundry. Most of the tonnage placed during the week has been for delivery the first quarter of the new year. While prices at seaboard points for imported iron have been very near domestic quotations, no sales for import have been made as yet. Representatives here of English furnaces say they have received many inquiries in the matter, one being for 10,000 tons. They say that Middlesbrough No. 3 could not be delivered at seaboard points at the present time for less than $17.50. They are positive that imports will be contracted for in a few weeks. As for the domestic situation in general, gossip as to the immediate future of the market

is very hopeful. Many are unwilling to express opinions as to the future course of prices, until more is known than now as to the extent recent purchases represent provision for actual requirements. It is said that there is scarcely a consuming interest that has not purchased iron to the extent of at least 25 percent in excess of what orders on hand or in prospect will require. New York quotations at tidewater follow: Northern No. 1 foundry, $17.25 to $17.50; No. 2 foundry, $17.00 to $17.25; No. 2 plain, $16.50 to $16.75; No. 1 Southern, $17.50 to $17.75; No. 2 Southern, $17 to $17.25; No. 3 foundry, $16.50 to $16.75; No. 4 foundry, $16 to $16.25.

Rails.—No meeting of the pool has been held during the week, and none is scheduled for the immediate future, according to reliable authority. As the allotment situation stands now, there is nothing in the way of the price for next year being fixed, and that it will be $28 at mill seems a certainty.

Finished Iron and Steel.—There were no sales of any consequence made in structural shapes during the week, but business in sight, which is likely to go to the leading interest, including a warehouse at Cincinnati calling for 3,500 tons, an addition to a dry goods store in Chicago requiring 3,500 tons, and an office building in San Francisco, calling for from 1,000 to 2,000 tons. The Boston Elevated contract for over 10,000 tons is still unplaced. Railroads have specifications out that call for from 40,000 to 50,000 tons, but final orders may not reach that figure. An advance in structural shapes is looked for this month, with some talking 1.60c base. In plates, bars, and sheets new business closed during the week was very good, and advances in all of them is talked of. New York prices at tidewater follow: Angles, 3 to 6 in. x ¼ in. and heavier, 1.54½c; beams, 3 to 15 in., 1.54½c; channels, 3 to 15 in., 1.54½c; beams, 18, 20 and 24 in., 1.64½c; tees, 3 x ¼ in. and heavier, 1.59¼c; plates, carloads, tank, 1.54½c; flange, 1.64½c; marine and ordinary fire box, 1.74½c; refined iron bars, 1.54½c; soft steel bars, 1.44½c; sheets, in carload lots, New York, No. 28, black, 2.40 to 2.45c; galvanized, 3.40 to 3.50c.

Old Material.—The feature of the week has been the heavy purchases of scrap material, at least 25,000 tons having changed hands. There continues to be an excellent demand for everything on the list, with prices continuing irregular, but with an upward trend. Holders still show an unwillingness to sell, being more convinced than ever that prices are going still higher. We quote f. o. b. cars:

Old iron rails	$16 00 to 17 00
Old steel rails, long lengths	15 00 to 15 50
Old steel rails, short pieces	14 50 to 15 00
Relaying rails	19 00 to 20 00
Old car wheels	14 00 to 14 50
Old iron car axles	19 00 to 20 00
Old steel car axles	16 00 to 17 00
Heavy melting steel scrap	15 00 to 15 50
No. 1 railroad wrought scrap	17 00 to 18 00
Iron track scrap	15 00 to 16 00
Wrought pipe	10 00 to 11 00
Ordinary light iron	10 00 to 11 00
Cast borings	6 00 to 7 00
Wrought turnings	8.50 to 9 50
No. 1 machinery cast	12 00 to 12 75
Stove plate	9 50 to 10 00

PHILADELPHIA.

Dec. 6.

There is less activity in this market at present, a condition which naturally follows the heavy buying movement of November. Arrangements are being made to blow in a number of furnaces and the production will be considerably increased this month. Hence higher prices of pig iron are not expected. Specifications on finished products have not kept pace with the buying. Those who have had long experience are disposed to be conservative.

Pig Iron.—Sellers have taken orders to such a large extent recently that they are not willing to make contracts extending into next year. If prices are to be advanced, they want to get the benefit. Mill irons are very strong and command $15.75 to $16, delivered. Basic is also in strong demand. Foundries are said to be carrying pretty good supplies and pressure for deliveries is not expected to be strong. Scarcity of coke is a factor to be considered. We quote as follows, Philadelphia delivery: No. 1X Foundry, $17.25 to $17.50; No. 2X Foundry, $16.50 to $17; No. 2X Plain, $16 to $16.25; gray forge, $15.75 to $16; basic, $15.50 to $15.75.

Finished Material.—Demand is less active, but business cannot be described as dull. Buyers placed orders freely in anticipation of higher prices. Mills are well supplied with work. We quote: Plates, 1.43½ to 1.48c; beams, channels and angles, 1.53½ to 1.65c, according to specifications, and small angles, 1.50c to 1.55c. Bar iron is quoted 1.53½c for carload lots and over; steel bars, 1.43½c.

BIRMINGHAM.

Birmingham, Ala., Dec. 5.—Alabama pig iron quotations have advanced at some furnaces and No. 2 is now being sold at $13.75 against $13.50 last week. It is learned that several thousand tons of iron have been sold at the new price. The inquiry is steady, some of the would-be purchasers asking about iron for delivery during the last half of the coming year. The local consumption is quite heavy. Cast iron pipe foundries, car wheel works, foundries and machine shops and rolling mills are requiring much iron for their operation. The steel plants are taking up all the iron from six furnaces, the steel plant of the Tennessee Coal, Iron & Railroad Co. requiring the iron made at the five Ensley furnaces. The Ensley steel plant during the month of November turned out 21,487 tons of ingots while the blast furnaces they produced 28,100 tons of basic iron..

The production of iron in the Birmingham district is still not what it should be. The strike of the union coal miners, now in its sixth month, is still felt. The leaders of the miners assert that to yield means the disintegration of the union; in other words, that the companies will not further recognize the union. All miners, union and non-union, have been granted a five cent per ton increase for the month of December.

Iron shipments have been greater than the production in this district for some weeks now. Large sales have been made for the first three months of the coming year, and these indicate that every ton that can be manufactured will be required. The stock of iron in this district has dwindled down considerably and is now estimated under 40,000 tons. Companies carrying the greater portion of this surplus do not appear to be anxious to rush into the market even at the prices prevailing, intimating that $14 iron will be seen this week, while $15 iron is predicted for this month. Conditions were never before brighter, if only the production was better.

The following quotations are made by sellers: No. 1 foundry, $14 to $14.25; No. 2 foundry, $13.50 to $13.75; No. 3 foundry, $12.75 to $13; No. 4 foundry, $12 to $12.50; gray forge, $11.50 to $12; No. 1 soft, $13.75 to $14.25; No. 2 soft, $13.50 to $13.75.

The Metal Market.

NEW YORK.

Office of *The Iron Trade Review*,
Room 1315, No. 150 Nassau St., Dec. 6.

Pig Tin.—Following the publication of the monthly statistics, compiled by Secretary C. Mayer of the local Metal Exchange, which show an increase of 2,218 tons in the total visible supply, the market has been very weak, declines being from ½ to ¾ cents over last week's quotations. The statistics showed that the total visible supply on Nov. 30, was 14,412 tons, against 12,194 tons for October, and that the arrivals for the month were 2,204 tons, against 2,925 tons for October. In London the market has been very heavy, and prices are from £2 to £3 lower than a week ago. Closing prices today follows:

Spot, 29.25c to 29.50c; December, 29.15c to 29.40c; January, 29.10c to 29.35c. London's closings today follows: Spot, £134; futures, £132 15s. Arrivals for the month to date aggregate 655 tons, with 1,845 tons afloat.

Copper.—During the week a rather quiet situation has prevailed, with prices for the second week in many weeks remaining unchanged. Trade conditions are reported good. London during the week was without interest, but prices suffered a slight reaction. Today's closings follow: Lake, 14⅞c to 15⅛c; electrolytic, 14¾c to 15c; casting, 14½c to 14¾c. London's closings today follow: Spot, £66; futures, £66 7s 6d. Exports for the month to date were 1,003 tons. During November they were 22,077 tons, against 26,335 for October.

Lead.—Spot is quiet and unchanged at 4.60c to 4.70c. St. Louis is higher at 4.52½ to 4.62½c, according to brand. London declined to £12 17s 6d.

Spelter.—Spot in fair demand and unchanged at 5¾c to 5⅞c. St. Louis is stronger at 5¾c. London weaker at £25.

Antimony.—All grades declined during the week, Cookson's now being at 9¼c to 9¾c; Hallet's at 9.00c to 9½c, and other brands at 8.00c to 8.50c.

Quicksilver.—We quote $40 per flask of 75 lb. in lots of 100 flasks. London is £7 15s.

Nickel.—Sales are made at 40c to 47c for large lots down to a ton, and at 50c to 60c for small quantities.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1164 MONADNOCK BLOCK, Dec. 6.

The only change in metals this week is pig tin, which is down ¾c. Copper is firm and a fair demand for same is felt. Spelter is scarce and strong, though there is little call for it. We quote as follows: Lake copper, in carloads, 15¼c; in less than carload lots, 15½c to 15¾c; casting copper, 15⅛c for carloads, and 15¼c for smaller lots. Pig tin, carloads, 30c; lesser quantities, 30½c to 30¾c. Sheet zinc, 6.75c for carload lots of 600 lb. casks, and 7¼c to 7⅜c for less than carload lots. Pig lead, 4.60c for 50-ton lots, 4.75c for carload lots, and 4.85c for smaller quantities. Spelter is firm at 5¾c for carload lots, and 6c for lesser amounts.

There is a good demand for old metals, and prices are held about the same as last week. We quote prices paid by dealers as follows: Copper wire and heavy, 12¾c; copper bottoms, 11½c; copper clips, 12¼c; red brass, 11½c; red brass borings, 19¼; yellow brass, heavy, 8½c; yellow brass borings, 7¾c; light brass, 6½c; tea lead, 4⅛c; zinc, 4c.

Alabama Consolidated Coal & Iron Co.

President T. G. Bush of the Alabama Consolidated Coal & Iron Co. read his report on the operations of the company for the past year at the annual meeting of the directors held last week. Mr. Bush said in part:

"The affairs of the company are in a prosperous condition, particularly considering the very depressed period attending the iron business, which practically covered the past fiscal year of this company. * * * In the sales of iron, coal and coke, amounting to $2,270,000, there was not a dollar lost on bad accounts. The report as to earnings shows that for the five years, including the unprofitable year which has just passed, the net earnings were $1,648,494.52, which was sufficient to pay 7 percent on the preferred stock and leave an average of more than 6 percent on the common stock. The position as to the sales of iron of this company is strong, inasmuch as it carried during the depressed period a very large stock of iron rather than to sell same at the prices which ruled so low. This stock amounted to more than 30,000 tons on the 1st of November, and the company now has fully 20,000 tons of iron subject to sale and delivery between now and the 1st of January, 1905. It also has a fair percentage of orders on its books for the first quarter of 1905 at the present ruling prices, which, of course, are very profitable."

Representative Baker of Brooklyn, who was defeated for reelection last month has introduced a resolution in the House, instructing the attorney general of the United States to report to the House to what extent the steel rail pool violates the anti-trust law and what steps, if any, he has taken to prosecute criminally the members of the pool; also "directing the secretary of the treasury to suspend the collecting of the tariff tax of $7.84 a ton on steel rails, until such time as the United States Steel Corporation and others who form the steel rail association, furnish conclusive evidence that the amount paid by them to their employees for producing a ton of steel rails is greater than that paid by English steel rail manufacturers."

The American Steel Foundries, New York, advises us that it will probably increase the capacity of its Thurlow plant at Chester, Pa., next year, but that detailed plans have not yet been drawn.

The report from the customs collector of Conneaut, O., for November shows that 683,996 tons of ore were received last month, a gain of 363,212 tons over the receipts of November of last year although it was next to the lightest month of the year. The receipts of the port for this year have already surpassed those of last year's by 47,642 tons.

The Semi Steel Co., Cleveland, has, during the last eight months, equipped plants in all parts of the United States for the making of "sand lime brick." The total capacity of these plants is 200,000,000 per annum. The bricks are made of ordinary sand with a small percentage of lime added. The crushing strength of the sand brick is said to be 9,600 pounds to the square inch, while clay brick stand a pressure of from 1,700 to 2,000.

It is announced at Montreal that the stock of the Canada Car Co., organized by interests prominent in the Pressed Steel Car Co., Pittsburg, has been greatly over-subscribed. The total issue will be divided into three groups, one representing W. P. Coleman and New York associated, the second representing F. W. Morse, of Montreal and Grand Trunk interests and the third representing Senator Cox and Toronto capitalists.

The Cheswick Mfg. Co., Cheswick, Pa., manufacturers of hardware specialties whose plant was recently destroyed by fire have decided to rebuild at another location. A site near Pittsburg, or one in Ohio or one in Illinois is talked of. Plans for a new plant are already being prepared, including a main building 80 x 200 feet.

The tin plate plant of the Jackson Iron & Tin Plate Co., Clarksburg, W. Va., containing 8 mills and which was operated for a short time was sold under bankruptcy proceedings last week. It was purchased by the bondholders for $62,600. The plant was erected at a cost of nearly $200,000.

At Mercer, Pa., the suit brought by Charles Himrod against P. L. Kimberly was decided in favor of the defendant. The plaintiff claimed that Kimberly agreed to furnish 30,000 tons of ore for the operation of the West Duluth furnace at Duluth, Minn., that he did not carry out his alleged contract and that when the company failed he refused to take his proportionate share of the loss, it being alleged that Kimberly was to receive stock in the company in return for his ore. Letters were produced by Kimberly showing that he had been practically released from his contract before the failure, but the court held that action was barred by the statute of limitations.

THE JOHNSON ARCH PLATE.

The Johnson patent arch plate facilitates the work of repairing and rebuilding the door arches of melting furnaces. The arch plate when in use is attached to the ram of the charging machine. The furnace door is raised out of the way and the machine inserts the plate in the charging opening of the furnace, holding it there in proper position until the repairs

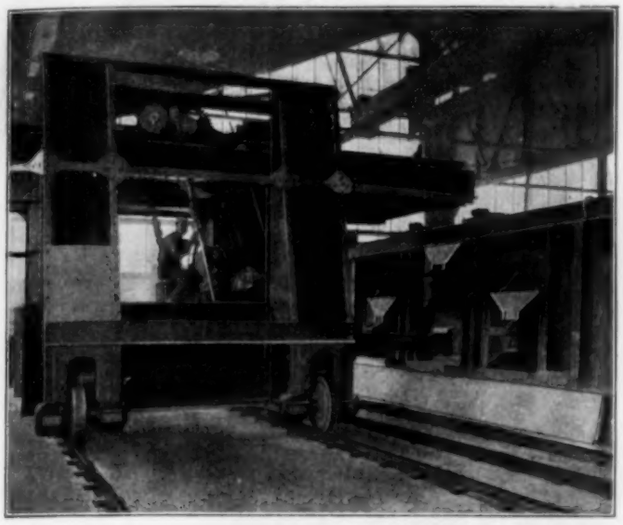


FIG. 1.—THE JOHNSON PATENT ARCH PLATE HELD IN POSITION IN ARCH BY CHARGING MACHINE.

are completed, when it is withdrawn and detached from the ram of the charging machine. The arch plate serves first as a shield against the heat from the interior of the furnace and the work of repairing the arch may be carried on without shutting down the furnace. In repairing arches without this device, it is necessary to build up a temporary protecting wall or bulkhead of brick; and on account of the heat. this must be done with long handled tools, making the process both awkward and tedious, as well as expensive, as it necessarily delays the operation of the furnace. This is obviated by the use of the Johnson arch plate and the work of repairs is greatly facilitated.

The Johnson arch plate also serves as a form on which the arch can be expeditiously relaid, supporting the arch during construction. The flange serves as a stop for the bricks in laying the arch. The arch plate is made of cast steel and hence is a permanent appliance which can be utilized at short notice, so that work which would ordinarily require hours in the old way can be done in a small fraction of the time, while the charge of steel is being melted down, and without any delay to teh furnace. The saving thus secured is readily apparent.

The Wellman-Seaver-Morgan Co. of Cleveland is sole manufacturer of this arch plate.

Minnesota Ore Roads' Dividends.

Numerous reports have recently been in circulation concerning earnings of the United States Steel Corporation from the Duluth & Iron Range and the Duluth, Missabe & Northern railroads, it being stated that the roads were paying to the corporation over $8,000,000 or 15 opercent of the par value of the outstanding capital of each road. When his attention was called to these reports Judge Gary said:

"These statements, which are accurate, came from regular reports to the Minnesota state railroad commission published about Oct. 1 last. These railroad companies are capitalized very much below their cost or value, and the dividends, therefore, are apparently large. Besides the dividends cover several years."

The Duluth & Iron Range Road, which has only 19 stockholders, the Steel Corporation owning nearly all the stock, earned in the fiscal year ended June 30 last $4,003,215. Its expenses were $1,839,014, and it declared a dividend of 150% amounting to $4,500,000. The company in the course of 20 years of operation has paid but three dividends, all of them liberal. In 1903 its net for the fiscal year was $3,578,294 and its surplus $2,566,170, after paying charges of $1,012,123. In 1902 its net earnings were $3,823,802, charges $1,210,398, and surplus $2,613,404. After paying a 150% dividend it still has a good surplus.

In the fiscal year closing June 30, the net earnings of the Duluth, Missabe & Northern were $3,701,416, and its charges were $1,836,484. After paying a dividend of 150% on its capital stock, which dividend amounted to $3,768,750, the company had a surplus as of June 30, of $3,163,565. The dividend paid by the Duluth, Missabe & Northern was divided among nine shareholders, most of it going into the treasury of United States Steel Corporation.

The Canadian Westinghouse Co., Ltd., has sold to the Hamilton Cataract, Power, Light & Traction Co. for use in its Victoria sub-station at Hamilton, Ont., two motor-generator sets each consisting of a synchronous motor and a direct current generator. The motor-generator sets will be of the two-bearing type, the generators delivering direct current at 550 volts to the railway system, and each being rated at 750 k. w. The synchronous motors will take two-phase current at 8,000 alternations and 2,400 volts, and will be rated at 1,380 h. p. The excess of capacity in the motors is provided so that they may be used from raising the power factor of the transmission system. Power is taken through lowering transformers from a high tension transmission line. The motor-generator sets will be built at the works of the Westinghouse Electric & Manufacturing Co. at East Pittsburg, Pa.

Stockholders of the Omega Steel Co., New Haven, Conn., which is now in the hands of a receiver, have asked the superior court to rescind an order directing the receiver to sue them for unpaid subscriptions for stock. They claim that the stock was fully paid for in property and that the most valuable asset is a secret process for making steel, which the receiver, Charles Hudson, says is of great value, but that he has made no attempt to sell this process. The petitioners further claim that if this process were properly disposed of, a sum would be realized which would be largely in excess of the outstanding indebtedness.

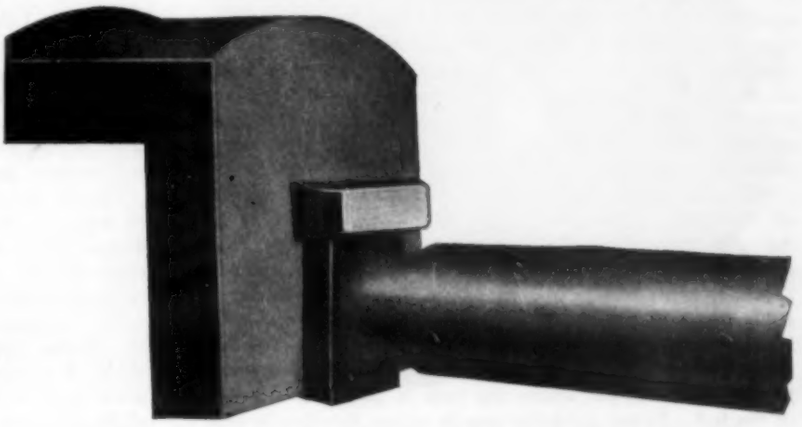


FIG. 2.—THE ARCH PLATE ATTACHED TO RAM OF CHARGING MACHINE.

A NEW TURRET LATHE.

This machine is the largest of three sizes of the hollow hexagon turret lathe built by the Warner & Swasey Co. of Cleveland and is especially designed and constructed for using the high-speed tool steels to their limit of efficiency. Great strength and rigidity, ample power, wide range of speeds and feeds instantly changeable, improved high speed turning tools, rapidity and convenience of manipulation are characteristic features of the machine.

Fig. 1 shows the lathe from the operating side; Fig. 2 is an end view illustrating the tool equipment, turret and saddle and Fig. 3 is the universal turner with roller backrest.

The machine takes bar stock up to 3⅝ in. in diameter through the automatic chuck, and turns same any length up to 36 in. The swing over the bed is 24 in.

The head and bed are cast in one piece. The bed is exceptionably deep and wide, and the vees are unusually large. The cone is geared 3½ to 1 and backgeared 13 to 1; the back gears being engaged and disengaged by friction clutches. There are twelve spindle speeds, ranging from 18 to 190 in geometrical progression, giving about 100 ft. surface speed on diameters from 2 to 3⅝ in.

The automatic chuck and the power roller feed handle bar stock of any shape. The chuck is held in the head of the spindle, which is forged solid, thus bringing the chuck jaws close up to the front spindle bearing, with a minimum of overhang. The chuck is operated by the long lever in front of the head, working through a system of compound levers, giving a powerful closing movement to the jaws. The jaws are quickly changed for different diameters of stock and a single screw adjusts the roller feed and the guide fingers.

The turret saddle slides directly on the bed and thus avoids all overhang. It is gibbed to the outer edge of the bed by flat gibs throughout the entire length. There are four changes of feed in either direction varying from 20 to 100 (revolutions of spindle to feed one inch), and screw-cutting feeds for leading dies are also provided. The feed rack is located on top of the bed midway between the vees and is as high up as possible, thus obviating all of the torsional strain in usual construction where the rack is placed at the side of the bed. Power quick traverse in either direction is provided for the rapid handling of the turret and for indexing, the movements being controlled by the lever in front of the turnstile. The independent adjustable stops for each face of the turret are located in front of the saddle, where they are easy of access for changing and adjusting, and at the same time are well protected from chips and dirt.

The hollow hexagon turret is 18 in. across, flats and has a broad bearing on the carriage. It revolves on and is kept central by a large taper bearing with ample provision for taking up wear and its trussed form provides an exceptionally rigid support for the tools, resisting and thrust as well as torsional strains. The index is nearly the full diameter of the turret, and the lock bolt is placed directly under the working tool.

The tool equipment regularly furnished is adapted for a great variety of work, including thread cutting. The universal turners are especially adapted for using high-speed tool steels, one of the special features of the tool being the roller back rest, which eliminates the excessive friction due to the high speeds, and the improved construction and great rigidity of the tool insure the highest degree of accuracy. The holder which carries the cutting tool swings about a stud, and can be easily and accurately adjusted by means of a screw, while an eccentric lever provides means for quickly withdrawing the tool from the work.

The carriage has 30 in. traverse longitudinally and 10 in. cross motion, both with four changes of feed in either direction. The longitudinal feeds vary from 24 to 120 and the cross feeds from 62 to 312 (revolutions of the spindle to feed one inch). These feeds have adjustable automatic trips. There are two stops with automatic trips, for the longitudinal travel; and the cross feed screw is fitted with a graduated dial.

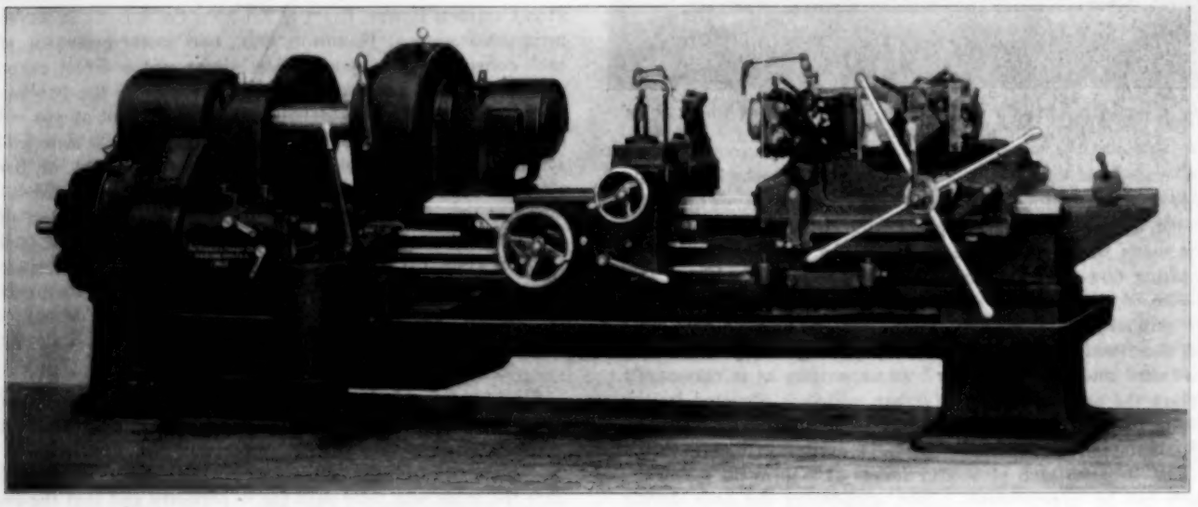


FIG. 1.—WARNER & SWASEY NO. 3 HOLLOW HEXAGON TURRET LATHE.

The front of the cross slide is equipped with a suitable tool post for holding, forming and turning tools, while the rear end carries a holder for cutting-off blades.

All the feeds are gear driven, and are quickly and easily changed by simply shifting a lever in the feed box. The latter is conveniently located in front of the head. The turret and carriage feeds are independent of each other.

The pan and oil reservoir are of large dimensions. A geared oil pump operates in either direction and delivers a copious flow of oil to the cutting tools for both the turret and carriage, through two systems of piping. All gears and other revolving parts are covered by suitable metal guards.

The machine shown in the photograph is electrically driven by variable speed motor, direct connected to the back gear shaft. For belt drive the spindle is equipped with a three-grade cone, and a triple friction countershaft. The net weight of the machine is about 12,000 lb.

The Janney Mfg. Co., Ottumwa, Ia., capitalized at $125,000 has been placed in the hands of a receiver, Joseph Dain, proprietor of the Dain Mfg. Co. The company was organized six years ago and engaged in the manufacture of farm implements and machinery. J. F. Merrill was recently elected president, succeeding Calvin Manning.

RECEIVED FROM THE TRADE.

A new general catalogue from the American Well Works of Aurora, Ill., supersedes all other price lists and shows a number of improved devices for well boring and equipment. It is really noteworthy that the business is so extensive, the pages of the catalogue covering a surprisingly large assortment of apparatus for well making, pumping, etc. One of the illustrations shows an outfit with a record of 30 6-in. wells 90 ft. deep, in 90 days, inclusive of delays and moving. There are several tables useful in pneumatic, steam and hydraulic computations.

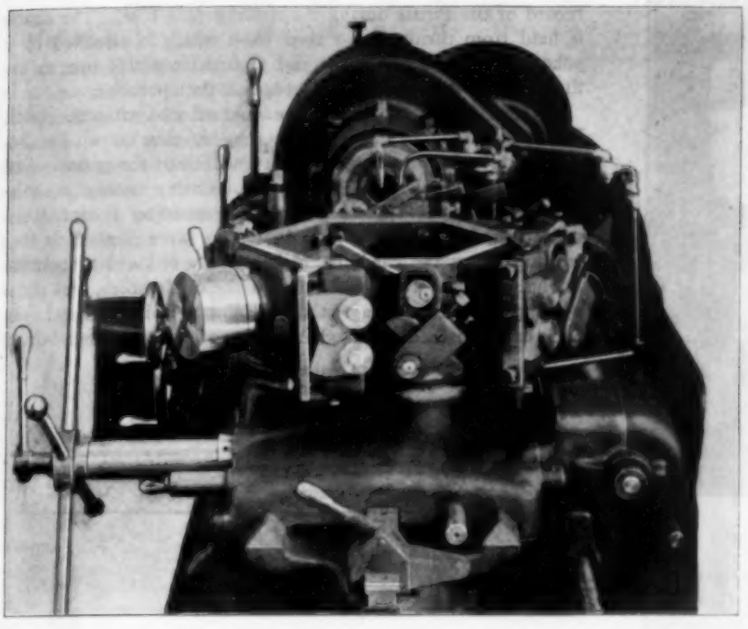


FIG. 2.—END VIEW OF NO. 3 HOLLOW HEXAGON TURRET LATHE, SHOWING TOOL EQUIPMENT, TURRET AND TURRET SADDLE.

A neat 12-in. rule graduated in tenths and sixteenths for desk use comes from the McClintic-Marshall Construction Co., builders of steel structures, of Pittsburg and Pottstown, Pa.

A 3½ x 5½-in. pamphlet on cranes has been prepared by the Northern Engineering Works of Detroit, Mich. A very few of the many types of cranes made by the company are represented in the small catalogue, but these are illustrative of the extent to which the firm has gone in the design and manufacture of cranes, overhead track and trolley systems. A number of illustrations show characteristic installations.

A new catalogue of 28 pages, 5½ x 8½ in., describes the graphite lubricants manufactured by the Joseph Dixon Crucible Co., Jersey City, N. J. The introduction deals in a general way with the growth of the graphite industry, the theory of graphite lubrication, the advantages of flake graphite and the relation of graphite to the theory of lubrication. The book describes the various lubricating graphites and graphite lubricants of the Dixon company, including their general uses. Those mentioned are Dixon's Ticonderoga flake graphite, special graphite No. 635, heavy graphite machine grease, waterproof graphite grease, graphite cup greases, axle grease, automobile and cycle lubricants, handy graphite rope dressing, and graphite pipe joint compound.

Pumping machinery is the title of a 132-page catalogue issued by Henry R. Worthington of New York. The apparatus comprises all of the types of pumping, condensing and measuring devices developed by this company in 64 years, the most prominent being the duplex steam pump, of which H. R. Worthington was the inventor. Special designs of this type of pump are adapted to boiler feeding, mine pumping, removing air and circulating water for condensers, waterworks service, fire service, etc., and it is claimed that a waterworks engine of this type, without fly wheels, has given a duty of 174,000,000 ft. lb. per 1,000 lb. of steam in a test made at the Central Park Avenue pumping station, Chicago. Some suggestion of the diversity of the business is advanced in the statement that the company has already made patterns for over six hundred different types of centrifugal pumps. The hydraulic works established in 1840 has built 225,000 pumps to date and has at the present time a capacity of 25,000 pumps annually.

The Reporter, sent out every few weeks by the Niles-Bement-Pond Co., of New York, has in the fifth issue an illustration of a lathe exhibited at the Centennial Exposition in 1876. This machine is provided with an interesting change gear device which was patented by Frederick B. Miles on Feb. 14, 1871. Another tool illustrated is a very large radial drill designed for armor plate work, and of full universal type. Power rotating gear is provided for the column. The saddle also has power traverse on the arm. The machine will drill to the center of a 20-ft. circle; greatest distance from face of column to spindle, 121 in.; greatest distance from baseplate to spindle, 108 in. The spindle is 6 in. diameter and has a traverse of 42 in. This machine was built for the new armor plate department of the Midvale Steel Co. The Niles-Bement-Pond Co. has also built two similar drills for the Carnegie Steel Co.'s armor plate department.

President Theodore J. Shaffer, of the Amalgamated Association of Iron and Steel Workers, whose headquarters are at Pittsburg, in discussing the dissatisfaction of the rank and file over his management of the Youngstown and Girard strikes, said that under no conditions would he be a candidate for re-election when his present term expires. Several attempts have been made to depose him, but all have been unsuccessful. During his administration the association has lost several very important strikes and during the past year a large number of mills have been lost to the association.

FIG. 3.—UNIVERSAL TURNER WITH ROLLER BACK REST.

The Alabama Consolidated Coal & Iron Co. has declared the regular quarterly dividend of 1¾ percent on its preferred stock, payable Dec. 1.

A TWIST DRILL DYNAMOMETER.*

BY WM. W. BIRD AND HOWARD P. FAIRCHILD, WORCESTER, MASS.

The introduction of the high-speed twist drill into modern machine shop practice has brought with it many new problems, and to supply some of the data necessary for their solution the

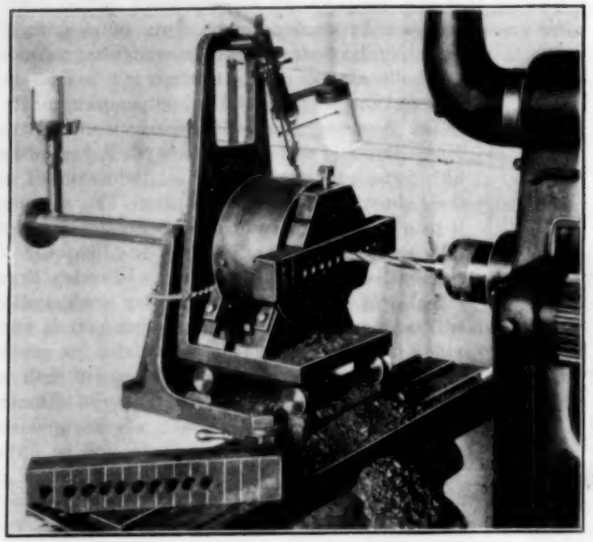


FIG. 1.

machine which is the subject of this paper was designed and constructed. It was taken as a thesis subject by George F. Read, Jr., of the class of 1904 at the Worcester Polytechnic Institute, and some of the preliminary work was done by him. All the experiments here reported, however, were conducted by the authors at the Washburn Shops of the Institute.

The machine is really a double dynamometer, measuring the twist or moment and the thrust of the drill. Two views are given of the machine in Figs. 1 and 2, which show the actual arrangements of the parts during the tests. It consists of a chuck with trunnions, mounted on roller bearings so that

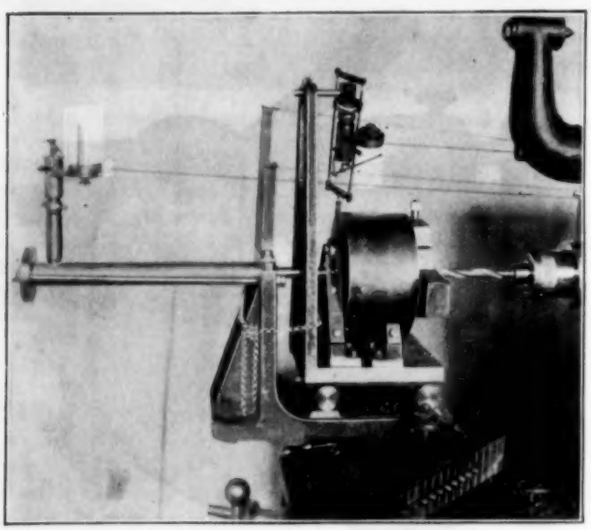


FIG. 2.

it is free to revolve about its axis at the same time it is free to move in the direction of its axis, being mounted on a carriage which is on rolls resting on the frame of the machine. This frame was placed on the table of a milling machine so that the axis coincided with the center line of the drill, which was driven by a spindle of the milling machine. The thrust of the drill is transmitted through the trunnion of the chuck to a plunger which is fitted into a long cylinder filled with oil. At the end of this cylinder is a smaller one also carrying a plunger. This small plunger is attached to a ball-bearing piston in a regular indicator. The drum of the indicator moves proportionately to the feed so that the card taken is a record of the thrust during the drilling of a hole. The chuck is held from turning by a steel band which is attached by a yoke to a second indicator, and a card from this one shows the twisting moment at each stage of the operation.

Both indicators were calibrated before and after the tests. The correct moments were obtained by hanging known weights over the chuck and noting the rise and fall of the pencil point. The thrust cylinder was placed in an Emery testing machine and known loads applied and a corresponding record taken on the cards. From these tests, curves were plotted so that readings from the cards could be readily reduced to pounds.

Figs. 3, 4, 5 and 6, are samples of the cards taken, and show a comparison of drilling in different materials as noted. In each case the feed was .008 in. per revolution, the number of

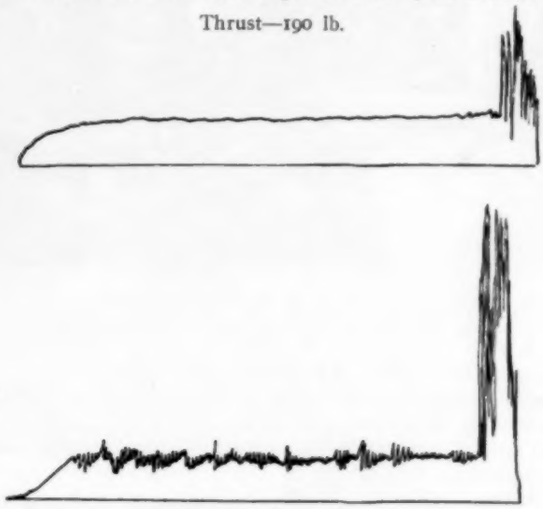


FIG. 3.—MATERIAL—BRASS. SPEED—260 R. P. M. FEED—.008 IN. PER REVOLUTION.

revolutions 260 per minute, and the size of the drill 5/8 in., with standard angle of 59 degrees.

It was decided to take up first the drilling of cast iron with high-speed steel. Blocks of soft gray iron were obtained and tested in the machine itself so as to get a number for each set of experiments as near the same degree of hardness as possible. A 5/8-in. Novo steel drill was taken as a good representative of the new steels.

The first experiments were on the effect of speed or number of revolutions per minute, all other conditions remaining the same. The revolutions were varied, from 140 to 600, but no material difference was shown by the cards in either thrust or twist. In other words, the power required to turn the drill varies directly with the number of revolutions, while the thrust does not increase with the speed, but depends upon the feed or the advance per revolution.

The next set of experiments was made to determine the relation between thrust and feed, the revolutions per minute remaining constant. From the first set of experiments it was shown that the limit of speed would depend upon the endurance of the drill, and with heavy feeds 420 revolutions was not far from this limit. Accordingly the second set was run at this speed, which for a 5/8-in. drill is about 70 ft. per minute for the cutting rate for the outer edges and for .020-in. feed a rate of drilling of about 8 in. per minute.

*Presented at the New York meeting, Dec. 7, 1904, of the American Society of Mechanical Engineers.

The range of feed was taken from .004 to .020 in. per revolution, the drill at the coarsest feed being somewhere near its limit. These feeds were all positive, a train of gears being substituted for the regular belt drive. The following table shows the results:

TABLE I.

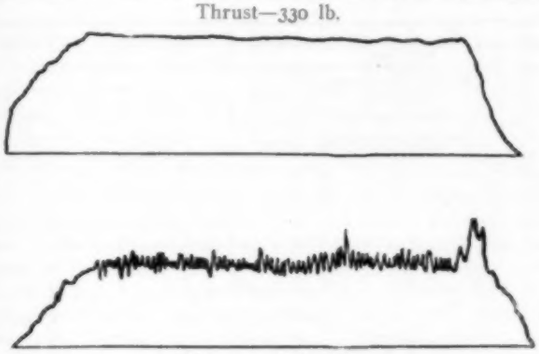
Feed:—inches per revolution—	.004	.006	.008	.010	.012	.014	.016	.018	.020
Thrust:—total in pounds—	240	280	330	360	410	460	525	620	725
Moment:—total in inch-pounds—	55	67	83	92	103	115	124	133	138

Fig. 7 gives the same data for thrust and feed in the form of a curve and shows that the thrust increases very rapidly with the coarser feeds.

Fig. 8 is a curve giving the relation between moment and feed, and shows that the moment does not increase at the same rate as the thrust. This would seem to indicate that less power is required to drill a given hole in a given time by increasing the feed per revolution rather than by increasing the revolutions. For example, to drill a hole in a 1-in. plate in 10 seconds could be done by running the drill 600 revolutions per minute and feeding .010 in. per revolution, but would require more power than by running at 300 revolutions with a feed of .020 in.

The question of the proper angle of the drill was next considered, and a set of experiments made with a constant speed and feed, the half-angle varying from 37 degree to 70 degrees,

Thrust—330 lb.



Moment—84 in. lb.

FIG. 4.—MATERIAL—CAST IRON. SPEED—260 R. P. M. FEED—.008 IN. PER REVOLUTION.

22 degrees less and 11 degrees more than the standard 59 degrees. The following table shows the results:

TABLE II.

Angle of drill.....	37°	45°	50°	55°	59°	65°	70°
Thrust in pounds.....	215	225	240	260	290	325	375

Fig. 9 is a curve for the same and shows that the thrust would be decreased by having more of a point on the drill. With an angle of 37 degrees, however, the drill would not stand upon repeated work. At 45 degrees it seems to do the work as well as at 59 degrees and with much less thrust. This would suggest a change in the standard angle for the new steels. The moment for the various angles remained practically constant, so that the driving power does not change with the angles of the drill.

Another interesting point in drilling which can be shown with this machine is the effect of first removing the center of the hole by the use of a small drill. Ten holes were drilled in a bar of cast iron with small drills, ranging from No. 53 to ½ in. in diameter and then each one counterbored with a ⅝-in. drill at 420 revolutions per minute and a feed of .008 in. per revolution.

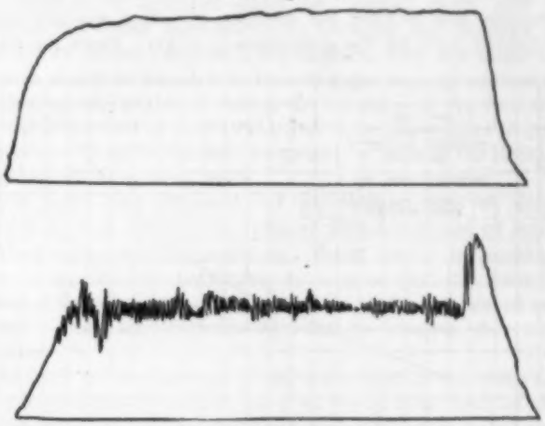
Table 3 gives the thrust in each case and shows that a hole 1-10 in. in diameter takes off about one-half the thrust for a ⅝-in. drill.

TABLE III.

Size of first hole—	.000	.0595	.0760	.0935	.120	.157	.189	.221	.250	.375	.50
Thrust for counterbore—	340	190	180	170	155	145	130	120	90	70	30

The range of experiments is almost limitless, and to cover the entire field for feed, speed, angle of drill, etc., for various materials and all kinds and sizes of drills will require much time and many tests. Some of the data so far acquired are

Thrust—560 lb.



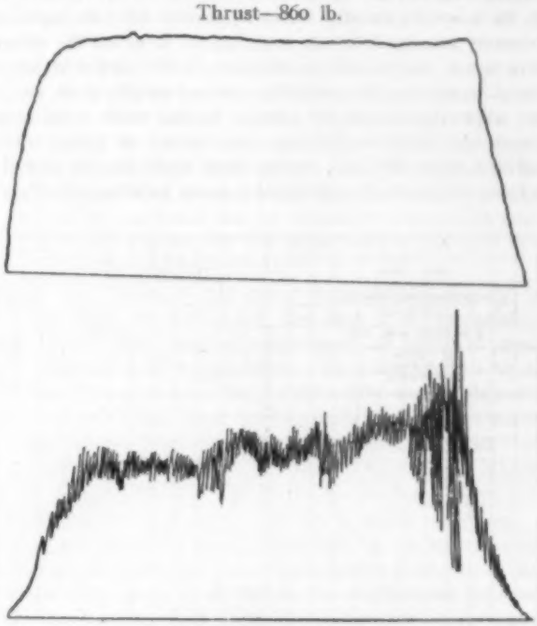
Moment—140 in. lb.

FIG. 5.—MATERIAL—TOOL STEEL. SPEED—260 R. P. M. FEED—.008 IN. PER REVOLUTION.

here reported with the hope that others may add to it, as well as suggesting lines for further experiments.

The Nye Tool & Machine Works, Chicago, recently incorporated, is devoting its entire time and capital to the manufacture of the Nye die, a recently invented pipe threading tool, which is said to be a radical departure from the hitherto accepted types of threading dies. The company is meeting with pronounced success, having found a quick market for all the dies which it has been able to make. The company expects to

Thrust—860 lb.



Moment—205 in. lb.

FIG. 6.—MATERIAL—MACHINERY STEEL. SPEED—260 R. P. M. FEED—.008 IN. PER REVOLUTION.

complete a finely equipped plant in a short time for the exclusive manufacture of these dies.

The old Adams' Foundry, Binghamton, N. Y., which was closed about a year ago, resumed December 1 under the control of a new concern called the Diamond Foundry Co.

GAS ENGINES IN POWER PLANTS.*

BY WM. T. MAGRUDER.

The object of this paper is to call your attention to the use of gas engines in power plants, to discuss some of their advantages, and to raise the question why they are not more frequently used for the generation of power. From the testi-

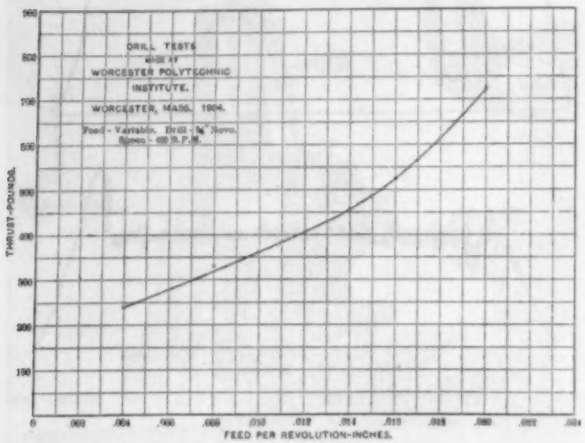


FIG. 7.—TWIST DRILL DYNAMOMETER.

mony of many witnesses who have had practical experience it would seem to have been repeatedly demonstrated that the best modern gas engines have many advantages over other forms of prime movers in the production of power for the generation of electricity, for the operation of pumping machinery and for manufacturing purposes. Among these may be noted the very low cost of the fuel consumed per unit of power generated; the low cost of operation and maintenance; the simplicity of the equipment; the facility for quick starting; there are no standby losses to provide for; the light load efficiencies are equal, if not superior, to those of the reciprocating steam engine; the waste heats of the jacket water and exhaust gases can be profitably utilized similarly to the various ways now in use for exhaust steam; there is no danger from steam boiler explosion; the excess of latent energy generated from the fuel during light loads can be stored in the form of gas in the gas holder more economically than in

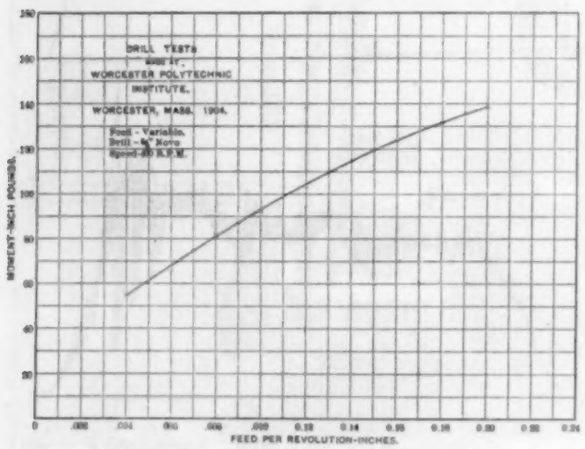


FIG. 8.—TWIST DRILL DYNAMOMETER.

any other form or by any other means; the largest possible units are not demanded in order to obtain high efficiency and economy, but on the contrary, gas power lends itself to the generation of power in small units; and lastly, the reliability of the plant for both intermittent and continuous operation under either constant or variable loads.

As to the cost of fuel, with natural gas at 8 cents per 1,000 cubic feet, the chief engineer of a large power station informs me that for a period of three months, the cost of gas was less than 2 mills per kilowatt hour, or less than 1½ mills per brake horsepower per hour, and that the total cost of fuel, labor, oil, waste and supplies was 4 mills per kilowatt hour, or three mills per horsepower hour. These figures are almost equaled by tests of plants using suction gas generated from anthracite coal at $5 a ton. Even in smaller plants, the amount of fuel used under average conditions should not exceed 1½ lb. of coal per brake horsepower per hour, and the cost of same should not exceed 3 mills per horsepower with coal at $4 a ton. Not a few suction gas producer power plants have delivered one brake horsepower for less than 1 pound of anthracite coal burned per brake horsepower per hour. While crude or waste oil are obtainable, the gas power plant reduces itself to simply an oil engine, an oil reservoir and a pump; and when the price of fuel oil is normal, the cost of fuel is reduced to less than ½ cent per hour per unit of power.

The cheapest oil power production that I have heard of is at Beaumont, Texas, where oil has sold as low as 10 cents a barrel of 322 lb., and capable of generating and delivering a horsepower for 1 hour for the combustion of less than 1 pound of oil. At that rate, the cost of power is less than 1-3 mill

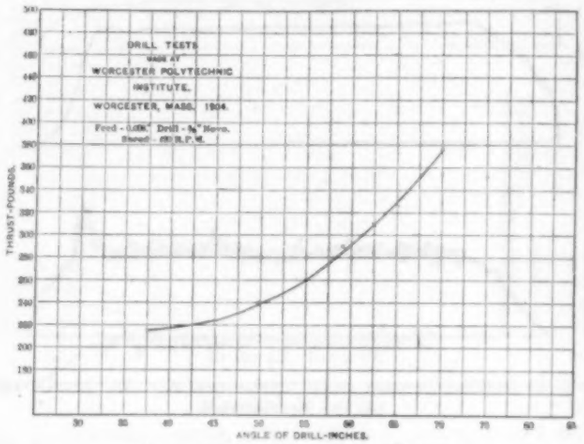


FIG. 9.—TWIST DRILL DYNAMOMETER.

per horsepower per hour for fuel. And even at $1 a barrel, the cost of fuel would be only 1-3 cent per horsepower per hour. With maximum efficiencies, reported at 40 percent in the case of certain Diesel engines, it stands to reason that the fuel consumption must be very much less than it is in the case of steam engines, where the average fuel consumption is 5 lb. of coal of 14,000 British thermal units calorific value per horsepower per hour, corresponding to an efficiency of 3.64 percent, or, as in the case of the very best results so far reported, of 1 pound of coal per horsepower per hour, corresponding to an efficiency of 18.18 percent, or one-half of the efficiency reported for the Diesel engines. It is seen, therefore, that it is not essential that the gas engine should have the advantage of the use of natural gas in order that it should compete advantageously and successfully with the steam engine and boiler in the cost of fuel used per unit of power.

In power plants, the gas engine need have but three auxiliaries, namely, a small air compressor for starting the engine, a magneto, or dynamo, for producing the current required for the electric ignition of the charge of air and fuel, and circulating pump for the jacket water. The air compressor in large plants is usually a motor-driven machine of low first cost, and entirely automatic. A 5-h. p. motor is a common size in large installations. In small plants, the

*Read before the Mechanical, Electrical and Steam Engineers at the Canton, O., meeting. Mr. Magruder is professor of mechanical engineering at the Ohio University, Columbus, O.

compressor is belt driven, or sometimes friction driven from the fly-wheel of the engine. The circulating pump need only be large enough to deliver from 50 to 60 gallons per hour for each horsepower generated for use in the jacket and for steam for the gas producer. The magneto, or dynamo, for ignition is such a small unit as hardly to be considered among the larger items of expense. It is, however, a very important one, and one which should be thoroughly reliable. In any large powerplant, the jacket water can be furnished from the water mains, the compressed air can be supplied from the mains which deliver power to pneumatic machinery, and the electricity can be supplied either from storage batteries, or from the main circuit, so that the gas engine and gas producer need have no auxiliaries peculiar to themselves.

If a gas producer is used, coal conveying and ash handling machinery may be deemed desirable, and may be profitably installed in large plants. If the plant can be so arranged that the coal cars shall deliver the coal on the upper platform of the producer and receive the ashes from the producer direct without any handling, even this otherwise desirable auxiliary may be eliminated. Steam engineers, when inspecting gas power plants, cannot help but be struck with the absence of pumps, feed water heaters, injectors, economizers, tall chimneys, superheaters, separators, condensers, vacuum pumps, both dry and wet, and the necessary piping and fixtures required by them, and which are all missing from the ordinary gas power plant.

With this simplicity of equipment, the cost of operation and maintenance should be necessarily less. A man competent to act as oiler in a large steam power plant should be equally competent in a gas power plant after a week's instruction and practice. The same kind of skill and ability which is required of the engineer for the former is likewise required for the latter, the only difference being that the knowledge demanded is somewhat different, but it is the same in kind. A hot box is a hot box, no matter whether it is on an engine run by steam, or one run by gas or air. The valve setting of one engine is similar in principle to the valve setting in the other, the only difference is in the method of utilizing the fuel and of operating the engine. The millions of dollars worth of gasoline automobile engines which are now being put out every year, and successfully run by persons having little, if any, knowledge of engine construction and operation, and the almost unanimous testimony to the effect that the gasoline automobile is more easily and cheaply maintained and operated than is the steam automobile, should cause one to hesitate before openly criticising the gas engine as being more difficult to operate and maintin than a steam power plant.

When it comes to the starting of an engine, the gas engine is excelled only by the air engine, as the time required for starting it and getting it up to speed is less than that required to start a water engine or a steam engine. Lack of experience and observation with windmills prevents my speaking positively as to whether the windmill has any advantage over the gas engine in speed of starting. At any rate, no steam engineer would think for a moment of attempting to start up a cold steam engine in the 30 to 60 seconds required to start a gas engine and get it up to speed at full load. After one has seen gas engines up to 1,000 horsepower started, and the full speed attained in 45 seconds by the watch, one begrudges the time necessary to warm up the cylinders of a steam engine of the same power.

The standby fuel consumption in a steam power plant sometimes reaches 10 percent when the pressure has to maintained continuously. In a gas power plant, using either oil or gas from a general main, the standby losses are entirely absent. In a gas blower plant which generates its gas in its own gas producers, the fuel consumption when the engine is not running should not exceed 10 lb. per hour for each producer, owing to the fact that the producer has no tall chimney to create such a draft as would cause the ordinary boiler dampers to leak badly. It is for these reasons that gas power has been chosen and is preferred to operate the fire pumps, not only of mills and factories, but also of city districts. A combination of advances along two similar paths may be seen in the recent introduction in Germany and England of gas engine driven automobile fire engines. One can easily see how it might be possible to have the gas engines operate as an automobile engine in taking the machine to the fire, and by the proper use of friction clutches cause the engines to proceed immediately to operate the pumps, as soon as the hydrant connections have been made.

The light load efficiencies of gas engines vary as much among them as do the efficiencies of different classes of steam engines under similar conditions. Being similar in construction, it would seem reasonable to suppose that the costs of running light would be about equal in the two kinds of engines. Tests and experiments seem to confirm this supposition.

As from 20 to 50 percent of the latent heat of the fuel used in a gas engine is carried away in the sensible heat of the jacket water, it requires but little genius to suggest that this hot water could be utilized in laundries, in dyehouses, and for hot water heating. As from 30 to 50 percent of the latent heat of the fuel usually passes off through the exhaust pipe. it has been repeatedly suggested that this heat should be used by causing the hot exhaust gases to pass over heating surfaces surrounding, or containing, either the hot jacket water, or additional water which it was desired to heat; or else that the heat be used in raising steam for use in steam engines or in steam heating, or for such other purposes as might be desired. These suggestions have been carried even to the extreme of constructing and operating an engine, one end of whose cylinder is used as a gas engine, and the other end of the same cylinder, acting as a steam engine, using the steam generated from the hot jacket water by the products of combustion of the fuel burned in the gas engine end of the cylinder. When it is remembered that the exhaust gases not infrequently leave the gas engine cylinder at a temperature of from 1,000 degrees to upwards of 1,500 degrees F., is it quite evident that such a scheme is perfectly possible. As the use of the fuel in a gas engine is more efficient than in a steam plant, there is of necessity a smaller waste of heat which can be utilized for hot water heating and the like, and for this reason gas power has no advantage over steam power as a system of heating, for the same reason that you "cannot eat your cake and have it too."

So far as I know, it has never been claimed for gas engines that they are fool-proof, nor that it is impossible to wreck them. The frequent experiences of ignorant people would disprove such a statement. They are subject to ailments peculiar to themselves, which only means that they should be protected from such possibilities. Gas engines have been known to go to pieces in the same way that steam engines have gone to pieces, but usually through no inherent fault of the engine. In any case, the damages done were not to be compared to those of a steam boiler explosion.

In a steam plant, the power generated by the boiler usually lags behind the demand for power required of the engine. A parallel case is to be found in the suction gas producer, where the demand made upon the engine for power causes the governor to regulate the quantity of gas sucked in and consumed at each stroke, and where the gas is generated only as fast as it is consumed. In pressure gas producers the excess of gaseous energy generated can be piped to a gas holder, where it can be reserved for use during the times of heavy load and without any loss from condensation, radiation or the like, and only at the cost of the interest on the investment and of wear and tear and depreciation.

It is well known that the commercial efficiencies of small steam engines are very much less than those of large engines.

This is chiefly due to the extra first cost and to the cost of maintenance and of operation of the many auxiliaries by means of which the lesser steam consumption is obtained in those plants having large units. Such is not the case with the gas engine to such a marked extent; hence, the gas engine lends itself to subdivision, and as a result partakes of all the advantages due to isolated units which are automatic. The ease with which gas and oil may be piped from a central source to the different engines, causes this system of power transmission to have many advantages which are surpassed only by the transmission of power electrically.

The reliability of a gas power plant is dependent upon the character of the installation and the ability of the engineer incharge to keep it up to its highest perfection of operation. In these regards the gas engine does not differ from the other forms of prime movers, or from other machinery. That gas engines are reliable when in proper hands can be easily proved by the numerous records of engines which have run continuously night and day without stopping for many months at a time.

If the above are some of the arguments which can be properly adduced for the use of the gas engine in power plants, I desire to ask the question, What are the causes which so far have prevented their more general introduction? Is it because the first cost of a gas power plant may slightly exceed the cost of a steam power plant of the same capacity? If so, the answer is that the increase in saving of fuel will more than pay for the difference under the usual set of conditions Few general managers prefer to earn only 10 percent on an investment of $10,000 when they could earn 20 percent on an investment of $12,000 for the same purpose. If, because the gas engine in large units is still something of a novelty, the reason is ignorance or prejudice; only study and personal experience will remove these difficulties, and it behooves us for the sake of our own self-respect to inquire into the subject, and see if there is not something in it for us.

Central Foundry Co.'s Report.

President Alfred Fowle, Jr., 116 Nassau street, New York, has submitted his annual report to the stockholders of the Central Foundry Co. The income account of the company and its subsidiary companies for the fiscal year shows:

Earnings on sales after deducting all operating charges		$467,504 46
Bond interest for year ending June 30, 1904	$231,780 00	
Expense of replacement and betterment of equipment	17,289 55	
Depreciation of properties, in suspense	$34,788 62	
Depreciation in properties	183,646 29	
	$218,434 91	
Total		$467,504 46

President Fowle says that the results of the year, while a disappointment to the expectations of the officers entertained a year ago, will, he hopes, be accepted as satisfactory, after taking into consideration the depressed conditions that have existed. The first year's operation of the Central Radiator Co. with a new line of supplies, incomplete, unknown to and untried by the trade, and in a largely restricted and declining market, has demonstrated its ability to maintain itself. During the past year its equipment has been materially increased, and now includes a full line of the staple sizes and styles of radiators.

Supt. McDonough, of the Muncie, Ind., plant of the American Sheet Steel Co., which has been idle for two years on account of the failure of the supply of gas, has announced that the plant will be re-opened as soon as the furnaces can be equipped for the use of coal. The plant employes about 600 men.

PRODUCTION OF GAS, COKE, TAR, AMMONIA, IN 1903

Since 1893, when the first plant of by-product coke ovens in the United States was completed at Syracuse, N. Y., the quantity of coke produced in such ovens has increased so rapidly that in 1903, 7.4 percent of the total coke product of the United States was thus manufactured. The successful development of this industry has been largely due to the profitable disposition of the by-products obtained in the manufacturing process. A demand has arisen not only for information as to the total quantity and value of coke produced, but also as to the quantity and value of the gas, tar, and ammonia produced at gas houses and at by-product recovery coking plants. In making its annual canvass of the coal mining and coke-making industries for the last two years, the United States Geological Survey has therefore extended its inquiries to cover all plants producing gas and coke from coal with the recovery of the tar and ammonia. Reports were received in 1903 from 528 companies. The facts gleaned from these reports are set forth by Mr. Edward W. Parker in a paper entitled "Production of gas, coke, tar, and ammonia at gas works and in retort coke ovens in 1903."

The total quantity of coal carbonized in 1903 was 5,843,538 short tons. The 528 companies produced 33,483,430,989 cubic feet of gas, of which 2,433,969,478 cubic feet were lost or unaccounted for and 31,049,461,511 cubic feet were sold. Of this total 73.9 percent was sold for illuminating purposes and 26.1 percent for fuel. The average price per 1,000 cu. ft. for all gas sold in 1903 was 97 cents. Prices for artificial gas are low in those States which have coal and natural gas among their resources. Such States are Illinois, Indiana, Kentucky, Ohio, Pennsylvania, West Virginia, and also Massachusetts, where a large portion of the coal gas made is a by-product from coke-making in retort ovens.

The total production of coke amounted to 3,941,282 short tons, of which 1,882,394 short tons were obtained from by-product coke ovens, and 2,058,888 short tons were the product of gas houses.

Many coke companies are engaged also in the electric light business, and coke produced at the gas works, as well as a considerable amount of tar, is used for firing in the electric light plants. Other coal-gas producers are also producers of water gas, and the coke from the coal benches is used for firing the water-gas plant. Some coke is also used in the carbonization of coal at some of the gas works. It will be noted, therefore, that not all of the coke produced at gas works in the United States is sold, a considerable quantity of it being consumed at the works where it is produced.

The total quality of coal tar produced in 1903 was 62,964,393 gallons, valued at $2,199,969, or 3.49 cents a gallon. The largest production of tar in both 1902 and 1903 was in Massachusetts, with New York second, Ohio third, Pennsylvania fourth and Alabama fifth.

Only about 20 percent of the companies that manufacture coke and gas reported the recovery of ammonia either in the the form of ammoniacal liquor or sulphate. The total quantity of ammonia liquor produced and sold was 64,396,662 gallons, which would be equivalent to 17,479,759 pounds of anhydrous ammonia, or 67,821,465 pounds of sulphate. The total quantity of sulphate of ammonia produced and sold in 1903 was 11,925,752 pounds. The total production in 1903, reduced to its equivalent in sulphate, was 79,747,217 pounds.

Comparatively little progress has been made in this country in the manufacture of chemical products from coal tar. Although we produce over 50,000,000 gallons of coal tar annually, we import at the same time millions of dollars' worth of chemicals obtained from coal tar. A conservative estimate would place the total value of these products in the wholesale markets of this country at $12,000,000.

The Red River Furnace Co., Clarksville, Tenn., will start its Helen furnace about March 1.

PERSONAL.

Charles M. Gunn, who for many years has been at the head of the Union Iron Works of San Francisco, has taken charge of the Columbia Engineering Works of Portland, Ore. S. M. Mears, president of the latter company, could not give the necessary time to look after the plant.

George A. Barnes, who has been in charge of the Chicago office of the Whitman & Barnes Co., has been made manager of the Akron, O., plant of that company.

Prince Sadanura Fushimi of Japan and party were the guests last week of Charles M. Schwab on a tour of inspection at the Bethlehem Steel Works, South Bethlehem, Pa. The visitors were taken from New York by special train. The prince will leave New Yerk Dec. 13 for San Francisco, and will sail for Japan Dec. 28.

Lewis C. Milholland has resigned the vice presidency of the Maryland Rail Co., Cumberland, Md., and sold his interest to Thomas F. Shannon, who was until recently secretary of the Rarig Engineering Co., Columbus, O.

W. L. Haynes, formerly chief mechanical draftsman for the American Bridge Co., Ambridge, Pa., is now connected with Pawling & Harnischfeger, Milwaukee, Wis., being in charge of the drafting-room.

At the Waldorf-Astoria, on the evening of Nov. 28, a complimentary dinner was tendered to W. K. Jenne, of Ilion, N. Y., by the board of directors of Wyckoff, Seamans & Benedict, manufacturers of the Remington typewriter, and a loving cup was presented. The presentation speech was made by President Henry Harper Benedict. The occasion was the retirement from active service of Mr. Jenne, who for more than thirty years has been superintendent of the Remington typewriter plant. He was retired from active service Dec. 1 with full pay, and will be appointed resident director and member of the advisory board. He has been succeeded in the management of the works by John Calder, who was assistant manager.

A. M. Fowler, formerly connected with the Union Iron Works Co., Springfield, Mo., as superintendent, has resigned to become vice president and general manager of the Phœnix Foundry & Machine Co., a newly incorporated concern also of Springfield.

S. R. Elliott, who has for a long time been connected with the Ashland mine, Ashland, Wis., has been appointed to the superintendency of the Negaunee and the Maas mines at Negaunee, and W. W. Graf, of Ishpeming, has been appointed general superintendent of the Cliffs and Moro mines of Ishpeming.

John G. Sanborn, formerly of the Chicago Pneumatic Tool Co., and more recently with the Chicago Storage Battery Co., has accepted a position with S. F. Bowser & Co., Fort Wayne, Ind., as railway representative for that firm's oil house equipment and oil storage systems. Mr. Sanborn will make his headquarters in Chicago.

William Devlin, until recently connected with the La Belle Iron Works, Steubenville, O., and who was formerly master mechanic of the Buhl plant of the Carnegie Steel Co., when it was operated by the National Steel Co., has been appointed superintendent of this Sharon plant to succeed W. E. Porter who recently resigned.

On Friday evening, Dec. 2, Andrew Carnegie entertained his former associates of the Carnegie Steel Co. at his home in New York. His former associates have organized the Carnegie Veteran association and this was the third annual gathering. It consists of 47 members of whom the following were in attendance: W. L. Abbott, C. W. Baker, V. R. Balsinger, P. T. Berg, W. W. Blackburn, H. P. Bope, L. T. Brown, J. J. Campbell, A. C. Case, Daniel E. Clemson, W. E. Corey, W. B. Dickson, A. C. Dinkey, John E. Fleming, R. A. Frank, James Gayley, J. C. Hoffman, M. Hunsicker, A. R. Hunt, J. G. Hunter, B. G. Kerr, George Lauder, John G. Leishman, Thomas Lynch, George E. McGague, W. C. McCausland, John McLeod, A. Monell, Thomas Morrison, G. D. Packer, A. R. Peacock, L. C. Phipps, J. C. H. Reed, Charles M. Schwab, J. E. Schwab, W. H. Singer, James Scott, Charles L. Taylor, E. Tener, H. H. Utley, G. H. Wightman and E. F. Wood.

K. Landgrebe, formerly with the Illinois Steel Co., and assistant superintendent of the Toledo Furnace Co., Toledo, O., since March, has been appointed general superintendent of the latter company.

Unusual Sheet and Tin Plate Activity.

This week the American Sheet & Tin Plate Co. placed its Pennsylvania tin plate plant at New Kensington in operation, and five additional mills at the South Sharon, Pa., plant also resumed, making 15 of the 20 mills at this plant operative. On Monday the Humbert plant at Connellsville, Pa., will resume. With the Humbert plant in operation the company will have 202 of its 242 tin mills in full operation. To have so many mills in operation at this season of the year is unusual and there is much speculation in the trade to ascertain whether this material is going into consumption direct or whether it will be allowed to lie in the warehouses of jobbers and large consumers. When the Humbert plant is in operation the only idle mills will be as follows: American, Elwood, Ind., 12 out of a total of 28; Anderson, Ind., 7; Laughlin, Martins Ferry, O., 7 out of a total of 23; Morewood, Gas City, Ind., 2 out of 6; Pittsburg, New Kensington, Pa., 7; Sharon, Sharon, Pa., 5 out of a total of 20. The regularly operative tin mills owned by independent manufacturers number 77. There are in addition thirty tin mills in five plants that are incomplete, lacking working capital or are idle on account of legal entanglements. These are not considered in the operative list. Only 14 of the 77 tin mills are now idle, showing that the independent tin plate manufacturers are sharing in the prosperity of the tin plate trade.

Only 19 of the 163 sheet mills operated by the American Sheet & Tin Plate Co. are now idle and it is probable that the majority of these will be placed in operation shortly. Independent manufacturers operate 147 sheet mills and at the present time approximately two-thirds are in operation.

Carnegie Steel Co. Blast Furnaces.

This week the Carnegie Steel Co. blew in its two idle stacks at Mingo Junction, O., and last week Clairton furnace No. 3 was placed in operation. This leaves only three idle stacks that are in such condition as to be operated in the near future. These are two new stacks at Donora, Pa., and one at the Lucy plant at Pittsburg. The North Sharon, Zanesville and two Columbus stacks will only be started in times of the heaviest consumption and it is altogether probable, that they will not be operated again. Deducting these four stacks from the company's list of operative furnaces it leaves only three idle out of a total of 47 operative stacks. Reports that the North Sharon stack and one Donora furnace would resume operation in the near future are denied, no orders having yet been issued to place them in operation.

The angle mill at the North Sharon works of the Carnegie Steel Co., Sharon, Pa., was placed in operation this week. This mill was installed about a year ago but was never operated owing to the condition of the iron market throughout the year. The blooming mill at this plant has been in operation for some time, but the open-hearth plant and blast furnace continue idle. The blast furnace is to be relined but it is doubtful whether it will be operated after repairs are completed undess demand increases tremendously.

THE IRON TRADE REVIEW

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SPECULATION IN THE IRON MARKET.

Whether because it is more than ever in the hands of Wall Street, or from whatever cause, the iron trade has plainly taken on a speculative cast in the weeks of the present upward campaign. Buying in anticipation of an advance in prices is not new, and every period of recovery after depression has witnessed it. It has been predicted, moreover, throughout the months of dragging prices for pig iron that have followed the sharp slump in the fall of 1903, that whenever consumers once reached the conclusion that the swing downward had spent itself, the simultaneous effort of many to cover for a portion of their expected needs would bring the familiar effect of buyers putting up the market on themselves. This feature of the recent advance in pig iron is therefore not surprising. But the parallel to the methods of Wall Street is in the plentiful spreading of intimations and predictions that prices in this and that material would be advanced within a given time. Alongside of predictions that steel stocks will reach a particular point in the upward movement by a specific date, we now have advance information that at certain meetings prices of this and that material will go up.

In the spring of 1902, when large buyers of steel bars were considering purchases, they were informed that on April 1 steel bars would be advanced from 1.50c to 1.60c. A large tonnage, including requirements for the year ending June 30, 1903, was placed at 1.50c and the price was advanced $2 a ton on April 1, as promised. In the wire trade, when under good control, as in the time of the Parks pool, similar announcements of advances have caused buyers to get under cover; the structural pools have also employed similar notifications to get a large advance tonnage on the books of the mills. But the habit today appears to be general and contagious. Even the producers of foundry iron, who are presumed to be freest of all iron manufacturers from any intention or ability to fix market schedules by decree, are beginning to catch the infection, and we hear statements to the effect that within a fortnight or a month a certain figure will be established, representing a further advance upon the then prevailing selling price.

One safeguard against hurtful consequences of this speculative taint is the fact that neither side of the market is looking far ahead. Comparatively little pig iron has been bought for delivery beyond April 1. In finished material, deliveries in bars extend to July 1, as, in some cases, of structural material and plates; but, on the other hand, in some lines sales are restricted to deliveries in the present calendar year. However, there is no doubt that in pig iron, as well as in steel bars, buyers have placed orders without strict regard to the tonnage that will be needed in the time covered by contracts, the intention evidently being to take all the material called for and stock it, in case the market advances. If there should be temporary backset, after the somewhat excited uprush that has taken place in pig iron, it may be expected that some deliveries will not be taken according to contract stipulation.

No doubt the price of pig iron, unsupported by any pool agreement, swung down too far under the effect of the extreme pessimism that had possession of the iron trade in the early part of the present year. Fair allowance should be made for this fact, in estimating whether the advance so far made is warranted by the changed conditions of the past two or three months. Account must be taken, also, of the influence exerted by the general expectation of industrial prosperity throughout 1905, following upon the heavy crops of 1904. Blast furnacemen, with better things in prospect, decided that iron for next year's delivery should bring considerably more than the profitless prices of 1904, and buyers, arguing from the same set of facts, have tried to get iron at as near the 1904 level as possible. The result is that the prices established under the late heavy buying have been to a considerable extent conjectural—buyer and seller agreeing in the opinion that they would be borne out by business conditions that do not now exist but that will exist in 1905. It is agreed that this is not the time of year for a new movement to gather such strength as to be felt in the enlarged operations of industries in all lines; and apart from new lake vessels, bridges, and car and locomotive business, there have been no important contributions to metal-working establishments. Heavy foundry work is sharply competed for, and prices as low as those of any month in 1904 have been quoted in this line. There must be a very marked improvement in many lines before the consumers of iron and steel can feel that they have seen anything like the betterment that has already come to iron and steel manufacturers.

It would be unfortunate if any of the improvement that has come to the iron trade thus far should be interrupted by overdoing the evident tendency to anticipate future good things. The speculative element is always present, for every purchase of iron involving deliveries several months ahead is to an extent a

speculation. But the speculative factor cannot exceed the factor of actual, tangible improvement in the business of the purchaser of material without the risk of a reaction that can only be hurtful.

STEEL RAIL EXPORTS LARGE.

The exporting of steel rails was the most active feature of the outward movement during October, due largely to the fact that the Canadian tariff became effective Nov. 1. The exports were 69,380 tons in October, of which 50,960 tons went to British North America, 4,309 tons to the West Indies and Bermuda, 3,075 tons to Japan and 6,538 tons to other countries of Asia and Oceanica. The total for the month was four times as large as for the ten months ending in October, 1903, and larger by 4,000 tons than for the same ten months of 1902. The exports of steel rails for the first ten months of 1904 were 342,076 tons.

The exports of billets, ingots and blooms have decreased from 26,175 tons in September to 12,989 tons in October. Exports of wire have increased from 8,045 tons to 13,092 tons, and wire nails from 1,969 tons to 3,120. The detailed exports of which tonnage is reported are as follows:

EXPORTS OF IRON AND STEEL FROM THE UNITED STATES—GROSS TONS.

	October		10 mos. end'g Oct.	
	1903	1904	1903	1904
Pig iron	1,550	6,926	13,534	43,354
Scrap	1,261	2,568	4,391	24,782
Bar iron	1,652	1,613	16,936	23,996
Wire rods	1,483	474	20,526	14,515
Steel bars	718	1,850	14,502	21,604
Billets, ingots and blooms	28	12,989	1,084	275,615
Hoop, band or scroll iron	194	453	1,621	2,604
Iron rails	.....	.....	143	1,387
Steel rails	6,379	69,380	17,900	342,076
Iron sheets and plates	143	516	4,501	3,899
Steel sheets and plates	1,050	7,702	10,127	38,110
Tin plates, terne plates and taggers' tin	2	1,001	170	6,383
Structural material	2,528	6,199	25,093	43,511
Wire	11,973	13,092	88,205	94,212
Cut nails	933	571	7,722	8,077
Wire nails	3,250	3,120	25,609	23,839
Other nails, including tacks	298	209	1,933	2,409
Total	33,442	128,093	254,087	970,373

The exports of ore were 41,652 tons against 19,880 tons in October of last year. In the ten months, the totals were: 171,392 tons in 1904 and 73,447 tons in 1903. The value of exports, excluding ore, but including machinery and other items of which tonnage is not returned, was $12,798,481 against $8,982,426 in October, 1903. For the ten months the totals were: 1904, $105,350,418; 1903, $81,696,786.

Imports were almost the same for October as for the preceding months and about half the tonnage of October, 1903. The total on articles named follows:

IMPORTS OF IRON AND STEEL TO THE UNITED STATES—GROSS TONS.

	October		10 mos. ending Oct.	
	1903	1904	1903	1904
Pig iron	18,704	8,074	566,090	69,294
Scrap	3,836	449	77,939	11,803
Bar iron	4,872	1,354	36,832	17,130
Iron and steel rails	2,821	3,213	90,094	37,444
Hoop, band or scroll	55	1	1,487	1,942
Steel ingots, slabs, billets or bars	10,343	731	253,553	9,579
Sheets and plates	264	160	8,160	3,775
Tin and terne plates	3,937	5,032	40,148	61,096
Wire rods	1,717	1,028	17,035	13,062
Wire and wire articles	405	363	4,158	3,372
Structural shapes	1,396	126	6,219	6,894
Total	48,350	20,531	1,101,710	235,373

The total value of imports of iron and steel, excluding ore, but including a number of lines in which tonnage is not ascertainable, was considerably lower in October than in September, it being $1,841,175 in September and $803,378 in October, 1904, against $2,551,911 in October, 1903. The values for the ten months were: $18,405,021 in 1904 and $37,204,145 in 1903. Iron ore imports were: 8,684 tons in September and 51,732 in October. For the ten months the ore totals were: 348,944 in 1904, and 897,030 in 1903.

Eastern Steel Co.'s New Structural Plant.

The Eastern Steel Co., Pottsville, Pa., has awarded the contract for the erection of one 28-inch beam mill together with shears and engine to Mackintosh, Hemphill & Co., Pittsburg. The mill will consist of four stands of three high rolls having steel housings. The mill will be driven by one pair of 48 and 72 x 60 cross compound reversing engines. These will be among the first cross compound reversing engines built in this country for rolling mill work, although they are used to some extent abroad. They will be equipped with a variable cut off, to insure economy under light loads. One hydraulic shear with intensifier, capable of cutting 24-inch beam blanks will be installed and will be equipped with electrically operated tables and a scrap conveyor. The contract also calls for the installation of one hot and one cold saw. These will be driven by electric motors mounted directly on them. The contract for rebuilding the present 32-inch blooming mill and equipping the same with new tables was also awarded Mackintosh, Hemphill & Co. The Garrett-Cromwell Engineering Co., Cleveland, has the engineering contract for all the extensions undertaken by the Eastern Steel Co.

At present there are four 50-ton open-hearth furnaces under erection with three soaking pits and a plant of gas producers. One 12 and one 19-inch mill are in the plant and are a part of the old equipment. The boiler capacity is to be increased to 7,000 h. p. and the crane equipment will be installed by the Alliance Machine Co., Alliance, O. The beam mill is to be placed in operation about July 1, next year and the old bridge shop is to be refitted and its capacity increased to 25,000 tons of fabricated material annually. It is estimated that the plant will have a capacity of 120,000 tons of ingots per annum. The officers of the company are: Veryl Preston, president; J. A. Burden, Jr., vice president; T. R. Foley, treasurer; E. L. Herndon, secretary and A. H. Beale, general manager. The main office of the company is at Pottsville and a branch is located at 71 Broadway, New York.

The new highway bridge across the Miami river at Elizabethtown, Ohio, is said to be the longest simple truss span in the world. It has a clear span of 586 feet. It is being built by Hamilton County, O., for which Frank Krug is county engineer. The bridge itself was designed and is being manufactured by the Brackett Bridge Co. of Cincinnati, of which H. G. Tyrrell is chief engineer.

The Driggs-Seabury Ordnance Co., Sharon, Pa., awarded the contract for the erection of a forging plant 110 x 200 feet to William B. Scaife & Co., Pittsburg. The main building of this plant is already completed and will be ready to operate shortly after the first of the year.

The American Sheet & Tin Plate Co. will add another furnace to its open-hearth plant at Vandergrift, Pa. It will have a capacity of 35 tons, the same as the other furnaces, of which there are now eight. Two additional galvanizing pots are also to be installed, increasing the total to twenty.

The Labor Situation.

CITIZENS' INDUSTRIAL ASSOCIATION.

Plans for organizing the employers of labor in this country to combat the injustices and excesses of labor unions were considered at the second day's session of the second annual convention of the Citizens' Industrial Association, held in New York last week. Daniel Davenport of Bridgeport, Conn., executive agent of the American Anti-Boycott Association, spoke on the purposes and work of that association. Frederick W. Job, secretary of the Chicago Employers' Association, expressed the belief in the employment bureau would be found a means of settling troubles between employers and employes. The report of the committee on resolutions, which was adopted, reaffirms the principles as adopted at the Chicago and Indianapolis conventions of the association, and again declares for the open shop, demanding only good faith and fair dealing, with discrimination against neither union nor independent labor; the freedom of the apprentice and the right of the individual to have a trade and follow it; the right of private contract, with equal obligation upon employer and employes. The resolutions declare that limiting the hours of labor, whether of brains or of the hand, is a matter for mutual agreement not a subject for arbitrary legislative enactment. The enforcement of the law is demanded. The resolutions direct that the executive committee take the necessary steps to secure a proper channel of activity for the correlation of interested organizations with the Citizens' Industrial Association of America. Continuing, the resolutions say:

Whereas, The limitation which the trades union sets upon the number of apprentices in any shop is largely responsible for the disappearance of skilled labor, is destructive of the industry and is one of the greatest disturbing factors in the industrial development of the country, in that it limits the right of the individual to learn a trade; and

Whereas, The effort made by the employer to increase the number of apprentices in a trade is necessarily hampered by the above limitations; therefore be it

Resolved, That the convention of the Citizens' Industrial Association of America recommend the establishment by boards of education of artisan schools under the control and direction of the State, giving a diploma, which shall be the evidence of the right to begin to practice a trade.

Resolved, further, That it be recommended to individual employers, so far as practicable, to establish training schools in their own shops and as rapidly as possible to increase the number of apprentices desiring to learn the trade.

Whereas, In his farewell address Washington declared a "well-regulated militia necessary for national defense," and,

Whereas, Organized labor throughout the country seeks to discourage and practically prohibit membership in the State militia; therefore be it

Resolved, That this association condemns this policy of the labor unions as disloyal and dangerous, destroying the natural nucleus of republican defense, weakening the attachment of the citizens to the State, impairing a patriotic inspiration to our children and ultimately necessitating an increase in our standing army, repugnant to our traditions and institutions.

David M. Parry of Indianapolis was re-elected president; J. C. Craig of Denver, first vice president; James T. Hoile of Brooklyn, second vice president; George A. Davis of Grand Rapids, Mich., third vice president; Major A. C. Rosencranz of Evansville, Ind., treasurer.

EIGHT HOUR LAW INVALID.

The New York Court of Appeals declared unconstitutional the law which prohibits a contractor from employing his men more than eight hours a day on city, county or state work. With Judge Haight alone dissenting, the court arrives at this conclusion, three judges holding that the law is unconstitutional, violating the 14th amendment in that it deprives an individual of property without due process of law. Two judges base their opinion on the result in the Rogers case, making their decision one of precedent. In the Rogers case, which the court decided in 1901, the law in question was what was called "the prevailing wages law," which requires a contractor with the city to stipulate that he would pay his workmen not less than the prevailing rate of wages in the locality. The two laws were quite different, but the court held that the legal principle involved was the same, and that if one was unconstitutional so was the other. In his dissenting opinion Judge Haight holds that the constitutionality of the law can be sustained as a police regulation in the interest of public health and morality.

In the decision just given and that of 1901 the New York Court of Appeals is in conflict with a decision of the United States Supreme Court on the same issue. The case that came before the latter court was that of Atkins, a Kansas contractor. The law of Kansas punishes a contractor on state work who works any employe on that contract more than eight hours a day. Atkins violated the law and was fined. The state supreme court sustained the validity of the law and the case afterward went to the United States Supreme Court on the contention that the 14th amendment was contravened by the Kansas law. The United States Supreme Court, Chief Justice Fuller and Justices Brewer and Peckham dissenting, sustained the Kansas law. Justice Harlan, in reading the decision said:

"We can imagine no possible ground to dispute the power of the state to declare that no one undertaking work for it or for one of its municipal agencies shall permit or require an employe on such work to labor in excess of eight hours in the day, and to inflict punishment upon contractors who disregard such a regulation. It can not be deemed a part of the liberty of any contractor that he be allowed to do public work in any mode he may choose to adopt without regard to the wishes of the state. On the contrary, it belongs to the state, as the guardian and trustee for its people, to prescribe the conditions on which it will permit public work to be done. No one is entitled of absolute right and as a part of his liberty to perform labor for the state, and no contractor for public work can excuse a violation of his lawful agreement with the state by doing that which the statute under which he proceeds distinctly forbids him to do."

INCREASE OF APPRENTICES.

The Iron Molders' Union of North America has voted by a small majority to increase the number of apprentices in stove foundries from a ratio of one apprentice to eight journeymen to a ratio of one to five. The ratio has stood at one to eight for years, before which it was one to ten.

METAL TRADES ASSOCIATION NOTES.

CINCINNATI, Dec. 5.—The St. Louis Metal Trades Association reports business quiet in the metal working lines and demand for skilled help light. No labor difficulties of any kind have been reported in the shops of members of that association.

J. W. Leigh, manager of the St. Louis Metal Trades Association, in his weekly bulletin announces the death of Mr. Wuerpel, of the firm of Dehner-Wuerpel Mill Building Co. Mr. Wuerpel died at his home in St. Louis on Saturday, Nov. 26. He was one of the earliest members of the association and took an active interest in its welfare.

In spite of the fact that the New York Metal Trades Association Employment Bureau has not advertised for workmen, quite a number have already registered at the bureau. Members of this association are beginning to use the bureau and quite a number have applied for workmen.

In a decision by the Appellate Division of the Supreme Court of New York the case of Jacobs, president of the Pro-

tective Coat Tailors and Pressers Union, against Cohen & Sons was decided against the union. The court says that the contract by which Cohen & Sons gave a promissory note and a promise to hire only union men was illegal and that the evident intent of the labor union was not to leave the employers free to act in the employment of labor. It was declared that the policy of the labor union was to compel the employers to keep out of their shops all workmen not members of the union. The combination disclosed, the court says, is one the purpose of which is to hamper and restrict freedom of employment on the part of both master and servant under a penalty of both loss of service and deprivation of employment and to coerce all workingmen within the field of its operation to become members of the contracting organization. Such a contract, the court holds, is distinctly contrary to public policy and is not enforceable at law.

The report of the American Federation of Labor in its meeting at San Francisco shows that the average membership of the Federation during the last year was 1,676,200, which is a gain of 210,400 over 1903. The membership has more than doubled since 1901. In 1896 its membership was only 272,315. In 1881 its membership was less than 50,000.

The Manufacturers' Association of Pittsburg reports that for the week ending Dec. 2 the number of men furnished employment was 28 and the number reported discharged or laid off was 14. Fourteen applications for employment were received.

The monthly letter of Commissioner Eagan, of the N. M. T. A., points out that the most important work the association, and other associations like it, can do is to bring to justice, regardless of expense, professional dynamiters, sluggers and others engaged in intimidating men desirous of working in open shops. The commissioner believes that the metal trades associations should be as relentless in following up such law breakers as the United States secret service is in running down counterfeiters, or the Adams Express Co. in following up express robbers.

The ballot issued on Dec. 1 to the members of the N. M. T. A. is reported to contain more names than any that has appeared in months. Efforts to increase the membership have been especially active recently in New England.

LABOR NOTES.

The iron molders of the Champion Iron Co., Kenton, O., went on strike Nov. 25 because the company had reduced their wages. After the men left work, President Carter announced that hereafter the plant would be an open shop.

Declaring that the American workman has been restricted by his union so that he has not done his best work, Wallace Downey, of the Townsend-Downey Shipbuilding Co., at Shooters' Island, Borough of Richmond, New York, compelled to close down on account of strikes last spring, has offered to re-open on a co-operative plan. He declares that the workmen will receive a share of the profits in addition to the prevailing rate of wages, and at the same time he expresses his belief that the uncertainty and constant change in the wages will be avoided. A surplus is to be maintained and deposited to the credit of the participating parties to secure wages and interest against reduction in dull periods.

President Theodore Shaffer, of the Amalgamated Association of Iron, Steel and Tin Workers, announces that he will not be a candidate for re-election to the presidency of that organization.

A revision of the wage schedule has taken place at the No. 2 blooming mill of the Pennsylvania Steel Co., Steelton, Pa., which applies to the helpers and loaders. The helpers have been reduced from $2.50 to $2.15 and the loaders, from $1.65 to $1.05.

An advance of five cents per ton has been granted the miners in the employ of the furnace companies operating mines on the open shop plan in the Birmingham district. This will affect a large number of men, raising the wage from 47½ to 52½ cents per ton. The average price received for pig iron by the Sloss-Sheffield Steel & Iron Co. during November was more than $11.50 per ton and less than $12.50 per ton, as ascertained by the examiner.

Notices have been posted of an increase in wages from $1.25 to $1.30 a day for laborers in the employ of the Dunbar furnaces, Uniontown, Pa.

President Roosevelt on Dec. 2 informed a delegation representing the Amalgamated Association of Iron, Steel and Tin Plate Workers, that he saw no way by which he could properly or legally interfere to bring about a settlement of the strike of the union employes of the Carnegie Steel Co. at Youngstown and Girard, O.

At a meeting of the Central Federated Union delegates of New York City, representing more than 150,000 workers, a committee of 10 was appointed to wage a campaign against manufacturers who insist upon the "open shop."

Canadian Industrial Notes.

TORONTO, ONT., Dec. 5.—The Disston Saw Works of Philadelphia have just completed arrangements for the erection of a plant in Toronto at a cost of $150,000.

A syndicate of American capitalists including Frederick S. Kenaston, Forest B. Wood and Harry A. Hunter, of Minneapolis; Q. S. Hackney, and Harris Richardson, of St. Paul; William H. Phipps, of Hudson, Wis., and W. B. S. Trimble, of Jamestown, North Dakota, has been given a mining license of occupation for three years, covering the territory known as Hunters' Island near the boundary in the Rainy River District where large deposits of iron ore of good quality are said to exist. The syndicate agrees to spend $120,000 in exploration, development and mining and may take up such portions of the territory as they may select on the usual terms of lease or purchase, subject to special conditions which may be imposed as to the quantity of ore to be mined. They are bound to have all ore raised made into pig iron in Ontario if practicable, and to sell for use in Ontario furnaces on equal terms to those given elsewhere by them.

A tinplate industry is to be established at Morrisburg, Ont., by Welsh manufacturers giving employment to 125 men. The immediate expenditure on buildings will be $100,000 with prospects of a considerable further outlay. The industry will require electrical energy to the extent of 3,000 horsepower.

The 20,000 tons of steel rails of the 80-lb class made at the works of the Consolidated Lake Superior Co., at Sault Ste. Marie for the Canadian government to be laid on the Intercolonial, have been inspected and reported to be up to all requirements. Over half of them have been forwarded to Montreal.

John Bertram, president of the Bertram Engine Works, Toronto, and chairman of the Dominion Commission on Transportation, died at his residence here on Nov. 28th, having failed to rally after an operation for appendicitis. Mr. Bertram had for many years been prominent in public and industrial affairs.

The New York & Pennsylvania Co., Johnsonburg, Pa., has recently placed an order with the Ball Engine Co., Erie, Pa., for two 1,000-h. p. vertical Corliss cross compound engines, direct connected to generator.

The La Belle Iron Works, Steubenville, O., contemplate the erection of an 84-inch plate mill and contracts will be shortly awarded. The mill will be used for rolling wide skelp in addition to plates. The company's steel capacity is sufficient to provide for the increased finished output and with its two blast furnaces in operation the entire plant is independent so far as raw material is concerned.

LAKE SUPERIOR IRON MINES.

Samuel Mather, H. G. Dalton, H. S. Hasleton and other representatives of Pickands, Mather & Co., Cleveland, have completed an inspection of the company's properties on both the old and Mesabi ranges, and as a result it is expected that there will be a considerable expansion of operations next year. A day was spent on the Menominee range. The Verona mine, near Vulcan, Mich., is idle and will so remain. The company has spent considerable money in endeavoring to locate a paying ore body on this property, but up to date has been somewhat disappointed, although much ore has been mined. The Vivian mine, near Quinnesec, is low grade Bessemer property and promises well. It is the intention to work the property to the limit the coming season. At the Hemlock mine it was decided to start work at once, sinking the shaft another lift, or about 100 ft. From the Hemlock the party went to Stambaugh and visited the big Baltic mine. This mine is expected to make a record breaking output next season. The Caspian mine will be opened next year and put into the shipping list. This is a wet property and the pumping will not be started for several months. The underground work at this property is well advanced. On the Gogebic a visit was made to the Mikado mine, which has been idle all year, but will be again operated next year, as will also the Cary. Shipments from the stockpiles of these two mines were made this year. After the other holdings on the Gogebic were visited, the party left for Duluth, where several days were spent at the mines of the Mesabi. The company has eight mines on the Mesabi, all of which have been active this year, except the Corsica and Troy. It has not yet been decided whether these mines will be operated next season or not.

The Leonard mine near Hibbing, Minn., of M. A. Hanna & Co. and others is ceasing shipments for the year after an output of about 150,000 tons. It is a milling property and is not yet thoroughly opened. This is its first year. At this mine a Thew automatic shovel has been in use in the bottom of the pit for mining ore and loading tram cars with success. It is the first shovel of the kind on the Mesabi range. It is expected that shipments from this mine the coming year may amount to 500,000 tons. Stripping had been impeded there the past few days on account of a strike of the laborers for a $2 wage scale. Men at most of the Mesabi operations are now getting that pay. The wage rate has been advancing recently and is now stiff. Mr. Brandt, who has been manager at the Leonard, has not taken the superintendency of Pickands, Mather & Co. mines as reported, but goes to Michigan.

The general rate of pay for common labor on the Mesabi range is now $2 a day, and stripping laborers employed by the Killorin-Philbin company struck recently, demanding an advance from $1.75 to that price. They made the Drake & Stratton men, employed at the Leonard mine, go out also. Work has recommenced, however, part of the old men and some new ones going to work. Many strikes of short duration have occurred on the Mesabi the past summer, chiefly at operations conducted by the Drake & Stratton Co. and because the wages paid were what the men considered too low. These have been detrimental to work at mines and have been distinctly bad for all concerned. Mining superintendents have been troubled by the attitude of some of the stripping companies, which, during part of the season at least, have paid wages generally regarded as below the prices on which their contracts were based.

All Vermillion range mines have closed shipments for the year, including Minnesota, which at the last had six and seven crews at work loading and hauling to dock its 100,000 tons of old stocked ore.

All the Pickands, Mather & Co. mines have closed for the year, Elba at McKinley, Mesabi range, having been the last one to cease.

The last of the timbers of the Blue mine shafthouse, Negaunee, Mich., has been removed. After all the braces had been disconnected from the main timbers a locomotive was hitched to the shafthouse and it was pulled over. All work at the mine is now discontinued, which throws out many workmen. The concrete piers for the new shafthouse are under way and the property will be a producer again in a few months.

Arcturus mine, on the western Mesabi range, which has been under option to the Oliver Iron Mining Co. for some months, has been taken over by that company. It contains a large tonnage of ore too much mixed with sand to be available for shipment without washing up, and experiments the past season lead to the hope that washing may be successful. There are about 12,000,000 tons of ore in the mine, some of which is fair grade as it lies, and all will be excellent, hard ore, largely Bessemer, when washed. It is on the line of the Great Northern road, and at least 20 miles from any of the lines belonging to the Steel Corporation, so it is probable that its purchase means the extension of the Duluth. Missabe & Northern to the west. The probability is that a large additional tonnage of ore in this vicinity may be bought by the Steel Corporation.

Three bailers and two sinkers are working at the Great Western mine, Crystal Falls, and the water is going down very rapidly. It is thought that the water may be out in a week or two and then the mine will be reopened for steady operations. Arrangements for unwatering the Dunn are progressing, and it is probable that a large part of the machinery at Great Western will be taken there. At the same company's Tobin mine they are putting in new surface improvements and will make this a fine looking permanent property at once.

Mansfield, which was caved two weeks ago, and where the old shaft was ruined, is to be unwatered at once through the new shaft. There is only about 30,000 tons left in stock.

Chapin, Aragon, Mansfield, Dober and Iron River, Oliver Iron Mining Co.'s mines on the Menominee range, have shipped as follows this year: 540,000, 374,915, 57,609, 64,205, and 17,238 tons respectively. This is much less than a year ago, but it cleans up stocks quite well. All the mines but Mansfield are working steadily and will have large stocks at the opening of navigation.

William L. Staley has filed suit against the Central Car & Foundry Co., Vincennes, Ind., and the Vincennes board of trade for $30,000 damages, and asks that a receiver be appointed for the company. He alleges that the company gave him a contract for building its plant and when the first payment became due a month ago, the officials informed him they were without funds. Staley claims that the foundations for the plant represent a cost to him of $15,000.

A recent paragraph in this paper connecting the name of the Lacey-Buck Iron Co. with the Chattanooga furnace was incorrect. The Lacey-Buck Iron Co. is not identified with this furnace and has had no intention of acquiring it.

A bid of $275,000 has been made by eastern capitalists for the Coxey Steel & Silica Sand Co., of Mt. Vernon, O., which has been in the hands of a receiver for more than a year. Jacob S. Coxey has filed a personal petition in bankruptcy. His liabilities are given at $287,000. His assets consist of 2,500 shares of stock in the Coxey Steel & Silica Sand Co. and an unsecured note for $11,000.

The Buena Vista Iron Co., Buena Vista, Va., which has a track between 7,000 and 8,000 acres on which there is said to be rich deposits of iron ore, has been incorporated with a capital of $100,000, although it has been in operation for several months.

On Dec. 1 the name of the James P. Wetherill Machine Co., Chester, Pa., was changed to the Wetherill Bros. Machine Co.

FOREIGN IRON AND STEEL NOTES.

The report is current in British iron trade circles that the Swedish government has decided to purchase only basic rails in future, but in some quarters this is questioned.

Wm. Jacks & Co., iron and steel merchants, 49 Leadenhall street, London, E. C., in their report on pig iron for the third week in November show that shipments for the year up to that time fell off from those of 1903 by 41,798 tons from Scotland, 37,858 tons from Cumberland, and 199,841 tons from Cleveland. The furnaces in blast numbered 84 in Scotland, 77 in Cleveland, and 25 in Cumberland, against 87, 80, and 27 respectively the year previous.

It is stated that Head, Wrightson & Co., Ltd., of the Teeside Iron Works, Thornaby-on-Tees, recently booked contracts for two steel pit-head gears, 70 ft. high, for the Penalton Colliery, South Wales, and also for a coaling pontoon plant at Southampton for the Powell-Duffryn Steam Coal Co., Ltd.

The British Tariff Commission is still holding sessions, and there have been 75 sittings in all. Representatives of the iron and steel trade are giving testimony as to the need of duties on their products.

David Colville & Sons, Ltd., of the Dalzell Steel Works, Motherwell, Lanarkshire, have erected in their works what is considered to be the heaviest quadruple weighing machine in the world for weighing railway cars. The machine was designed and constructed by the patentees, Henry Pooley & Son, Ltd., and is capable of withstanding a load of 220 tons.

The directors of Dorman, Long & Co., Ltd., of Middlesbrough, manufacturers of structural shapes, sheets, etc., in their annual report refer to the unsatisfactory trade conditions in Great Britain in the past year. At the Clarence Steel Works extensive improvements have been made.

The latest information concerning the German Steel Syndicate's operations is that on steel billets and other semi-manufactured material, prices will hereafter be quoted c. i. f. English ports instead of f. o. b. Continent. It has been intimated that this is the result of negotiations between Messrs. Farrell and Hunsiker of the United States Steel Products Export Co. and representatives of the German Steel Trust. A London market review says: "Some people incline to the view that the move is intended to crush out of existence the big merchant firms in London. Others think that it is a working arrangement to get the whole of the business worth having in the hands of the two big steel trusts without fear of competition. Whatever be the motive, there is no doubt as to the importance of the effects which the carrying out of such a policy must exercise upon a merchant. A suggestion which finds some favor in well informed circles is that the arrangement may be preliminary to a large export business in half-finished goods being done for export to the United States next year, the American Steel Trust buying all its requirements in Europe at first hand without the intermediary either of the Verband sale-agents in London or of the London merchants who in former years have derived profit from this class of business. That the arrangement, too, will not please all consumers is pretty clear. The prices which have been fixed apparently allow of a 5s freight, but Newport and Swansea buyers who have been doing business on f. o. b. terms have been able to arrange freight at considerably below 5s, and are therefore likely to be dissatisfied, while, on the other hand, possible buyers in the Glasgow district might jump at the opportunity of obtaining supplies at a price including only 5s for freight. Meantime the current quotations put forward are: Blooms, 75s, c. i. f. good English ports; billets, 77s; bars, 79s."

An agreement between steel joist manufacturers in Belgium, Germany and France is expected to become operative shortly, and affects the export trade. The London *Iron and Coal Trades Review* says: "The agreement fixes the prices of joists at £4 5s per ton f. o. b. Antwerp for a minimum quantity of 1,000 tons, at £4 5s 6d per ton between 500 tons and 1,000 tons, £4 6s 6d for between 250 tons and 500 tons, £4 7s 6d for between 50 tons and 250 tons, £4 8s 6d between 10 tons and 50 tons, and £4 12s 6d for lots of less than 10 tons. The allotments of the three countries are as follows:—Germany, 73.45 percent on the basis of a combined export trade of 460,000 tons per annum; Belgium, 15.05 percent; and France, 11.50 percent. The apportionment given to the Belgian works is much less than would have been the case if the arrangement had been made several years ago, as the exports were considerably greater. For instance, the quantity of joists sent out of the country, which amounted to over 70,000 tons in 1894, gradually advanced to 122,000 tons in 1898. In the following year there was a decline to 109,000 tons, in 1900 to 80,000 tons, and in 1901 to 23,000 tons, but in 1902 the exports made a recovery to 61,000 tons, and in 1903 to over 64,000 tons.

Proposed Steel Plant at New Pittsburg.

(Special Telegram.)

PITTSBURG, Dec. 7.—Charles G. Zug, until recently actively connected with the Sable Iron Works of Zug & Co., of which he was manager for several years and in which he is still largely interested, is organizing a company to erect a steel plant on a large scale at New Pittsburg, located on the Pittsburg & Lake Erie Railroad, forty miles from this city. No plans have been definitely accepted, but they include a finishing mill for rolling all kinds of merchant bars and shapes. The erection of an open-hearth plant is being considered, and it is probable that a blast furnace will be included. As the plans of the finishing departments have not yet been definitely passed upon, the size of the open-hearth department has barely been considered.

It has been rumored that Zug & Co. would remove their Sable Iron Works to New Pittsburg, but officials of the company deny that they are associated with the new venture. The Sable Iron Works are located on three acres of the most valuable manufacturing property in Pittsburg, and as additional land cannot be secured, the company will locate elsewhere eventually when the present site is disposed of to advantage. New Pittsburg is an excellent manufacturing site and it is not a violent assumption that ultimately the company's sheet mills and iron plant would remove to that point, provided, of course, the project headed by Charles G. Zug is carried out.

Pennsylvania Terminal System at Pittsburg.

The Pennsylvania Railroad Co.'s Pittsburg terminal system, the construction of which was commenced three years ago, is fast nearing completion. The storage yards are 350 miles in extent and have a capacity of 40,000 cars of freight. In the Pittsburg district the Pennsylvania Railroad daily has an interchange of 5,000 cars and a daily delivery of 2,500 cars to local industries, making a total of 7,500 cars a day. The cost of these terminals and yards is estimated at $21,000,000 and it is believed that any freight congestion such as handicapped the iron and steel industries two years ago can be entirely prevented so far as this road is concerned.

No. 1 blooming mill of the Newburg works of the American Steel & Wire Co., Cleveland, has recently been making some excellent records. On the night run of Nov. 28, 463 ingots were rolled and on the day turn Nov. 29, 496 ingots were rolled, a 24-hour record of 2,211 tons. The month's tonnage is over 3,000 tons in excess of any previous record.

The Newport Iron & Brass Foundry Co., incorporated under the laws of Kentucky and having a plant at Newport, Ky., has changed its name to the Newport Iron Co. and has been incorporated under the laws of the District of Columbia.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

The results of tests of fans and blowers for foundry work made at the plant of Mackintosh, Hemphill & Co., were presented at the meeting of the Pittsburg Foundrymen's Association held on Monday, Dec. 5. The tests were made under the supervision of W. H. McFadden, chairman of the committee appointed by the association, and the paper detailing them was read by H. E. Field. So great was the interest in the results obtained that it was decided to devote the January meeting to a discussion of the paper. The blower and fan were loaned by the Connersville Blower Co. and the B. F. Sturtevant Co., respectively, while the Westinghouse Electric & Mfg. Co. provided the motor. S. H. Stupakoff took the high temperature measurements. The cost of installing the fan and blower was borne by Mackintosh, Hemphill & Co., and they also made all the necessary changes required in the piping. A vote of thanks was extended the concerns that aided in the tests and a committee of three was appointed to draw up resolutions of thanks to be presented to Mackintosh, Hemphill & Co. for the great interest they displayed in securing this information for the association. The results of the tests appear elsewhere in this issue. The attendance was the largest in the history of the organization and was as follows:

W. H. McFadden, H. E. Field, W. N. Hanna, S. McMillan, J. F. Tracey, L. E. Dunlap, Mackintosh, Hemphill & Co.
J. T. Speer, D. G. T. Justice, F. J. Stuver, John McCaffrey, Pittsburg Valve, Foundry & Construction Co.
William Yagle, Yagle Foundry & Machine Co.
John A. Logan, G. A. Bauman, Jones & Laughlin Steel Co.
H. F. Barker, Taylor, Wilson & Co.
G. C. Schade, Henry Gauerman, Braddock Machine & Mfg. Co.
E. H. Gersay, W. N. Missina, Harbison-Walker Refractories Co.
J. H. Sleeth, S. D. Sleeth, John Schick, Westinghouse Air Brake Co.
Geo. England, Edgar Thomson foundries, Carnegie Steel Co.
T. J. Dudean, Duquesne Steel Foundry Co.
G. Sheriff, O. B. McMillan, D. L. Eynon, Seaman-Sleeth Co.
A. O. Backert *The Iron Trade Review.*
G. E. Badgert, G. F. Warren, E. N. Holmes, Pennsylvania Malleable Co.
A. W. Slocum, National Car Wheel Co.
W. C. Gentry, Manufacturers' Association of Pittsburg.
E. D. Frohman, E. G. Seaman, J. S. McDonald, S. Obermayer Co.
F. H. Zimmers, John L. Orrell, Union Foundry & Machine Co.
James Kearns, J. F. Brown, R. H. West, Mesta Machine Co.
J. S. McCormick, J. S. McCormick Co.
Thos. D. West, Thos. D. West Foundry Co.
Wm. Phillips, Phillips & McLaren.
J. L. McCartney, Baird Machinery Co.
K. Warming, Paris, France.
Chas. Black, J. Morton Poole Co.
C. W. Jones, Rosedale Foundry Co.
W. E. Connely, Pennsylvania Car Wheel Co.
E. Kaye, W. J. Early & Sons.
Mr. Field, E. V. Johnston, Carnegie Technical Schools.
W. J. Dorsey, Enterprise Foundry Co.
B. D. Fuller, Westinghouse Electric & Mfg. Co.

Absorbed by Great Lakes Engineering Works.

The Great Lakes Engineering Works, Detroit, Mich., have taken over the plant of the newly organized St. Clair Engineering Co., at St. Clair, Mich., and will complete the construction of the two modern freighters for the Gilchrist Transportation Co. The Columbia Iron Works, before they went out of business two years ago, had contracts for the construction of two freighters, one for the Globe Steamship Co. and one for the Merida Steamship Co., which have since been merged into the Gilchrist Transportation Co. Work was stopped on the boats when the company failed. On December 1 a new company was organized known as the St. Clair Engineering Co. to take charge of the plant on St. Clair river and complete the boats and enter the general shipbuilding business. The following day the company was absorbed by the Great Lakes Engineering Works. One of the freighters will be delivered next July and another next August. The plans, which originally called for ships 416 ft. keel and 50 ft. beam, have been changed, and the new ships will be 464 ft. keel and 50 ft. beam. With the acquisition of the new shipyard at St. Clair, the Great Lakes Engineering Works will have two modern shipyards and an engine works capable of turning out any class of machinery. When the Columbia Iron Works built the plant at St. Clair, it was considered a modern concern in every detail.

Good Outlook for Structural Mills.

(Special Telegram.)

PITTSBURG, PA., Dec. 7.—Inquiries on account of bridges, elevated tracks and other railroad work has been heavier during the past three weeks than at any time in two years. Fitting shops report that they have been requested to bid on an immense tonnage that will be erected early next year. Nearly every railroad of importance is going ahead with work that had been deferred on account of the depression and the outlook for structural mills is very bright. The contract for the Boston Elevated, calling for 9,000 to 10,000 tons, will be let this week, while the work on the Pennsylvania elevated tracks at Chicago, 3,000 tons, will be placed shortly. It is expected that the contract for the Pennsylvania Co.'s Pittsburg elevated tracks, after many delays, will be awarded shortly after the first of the year.

Foundry Work in a Trade School.

Though they came late in the program of the recent Cincinnati convention of the National Founders' Association, the papers by J. L. Ketcham, of Indianapolis, and Geo. Q. Thornton, of St. Louis, on the training of foundry foremen and foundry apprentices, dealt with one of the most important matters presented to that convention. Mr. Ketcham's description of the work of the Indianapolis trade school, particularly in training boys to become molders, was accompanied by an appeal to foundrymen to aid in this work by subscribing for the help of boys taking the course in foundry work. The amount asked for a scholarship is $100 a year, for one, two or three years. The money is loaned to the boy learning his trade. He pays it back in time to the trustees of the school and it is then loaned to another boy, and the same circle is again completed, the money coming back to the trustees to be loaned again. Mr. Ketcham, whose business connection is with the Brown-Ketcham Iron Works, of Indianapolis, has set his mark at 50 scholarship subscriptions from the membership of the National Founders' Association. He writes *The Iron Trade Review* as follows:

"I am exceedingly anxious to have subscriptions to the scholarship fund by members of the N. F. A. If our boys are educated in such schools as the Winona Technical Institute of Indianapolis, the foundrymen of this country will, in a few years, have a better grade of molders. I was very much encouraged, indeed, by a few subscriptions which came promptly at Cincinnati, viz., from the retiring president, Isaac W. Frank, the commissioner of the N. F. A., O. P. Briggs, from Ferd. Schwedtman, editor of the *Citizens' Industrial Exponent* of St. Louis, also from George Q. Thornton. The very prompt response of these gentlemen to my appeal encouraged me very much indeed. I hope the publication of my remarks in your valuable paper will induce others to follow the noble example of the gentlemen just named and send in their subscriptions."

Henry W. Warrington, one of the pioneers of Chicago, died at Los Angeles, Cal., Dec. 1, aged 88. Mr. Warrington went to Chicago in 1847 and founded the Vulcan Iron Works, which he directed for 12 years. After acquiring a competence he retired. A few years ago he removed to Los Angeles.

SOME REFINEMENTS OF MECHANICAL SCIENCE.*

BY AMBROSE SWASEY.

As we open the twenty-fifth annual meeting of the American Society of Mechanical Engineers, the history of the society for a quarter of a century comes before us, and it is an occasion when it is especially appropriate to make some mention of the growth and progress of the society since it was organized. At the beginning, who would have dared to predict the wonderful advance that has been made in mechanical engineering? There was indeed a great field for work for just such a society. The long list of meetings which have been so fully attended, and so valuable to the members; the transactions, with their records of addresses, papers and discussions by men of experience in nearly every branch of mechanical engineering, and the constant growth of the society until at the present time it has a membership of nearly 2,900, all go to show that from the beginning it has been an earnest and progressive organization, and a most important factor in the progress of mechanical science and of the mechanic arts.

Not only those of us who were counted among its first members but those who from year to year have been added to its membership may well feel proud of its splendid record. The scope and influence of the society, which has been constantly increasing in the past, will surely continue, and never was its future brighter than at present.

I wish to speak of a few of those methods and mechanisms which have been developed and perfected to such a degree of refinement that they may be considered as almost beyond the practical, and yet were it not for such refinements they could not possibly be made to serve the utilitarian purposes which make them of such inestimable value to us all.

Mechanism for Measuring Time.

The division and the measurement of time is today, as it has been for ages, among the most important of the subjects affecting the welfare of mankind, and as time has rolled on and there has been a better understanding of the laws governing the universe, nearer and nearer has been the approach to perfection in the working out of these difficult problems, but the many limitations surrounding them have always kept their full solution somewhere in the future.

The diurnal revolution of the earth, which gives the solar day, and the revolution of the earth around the sun, the solar year, are the arbitrary divisions of time marked off with the utmost precision by the celestial bodies; and while the length of the solar day, from before the Christian Era, has been fairly well defined, the length of the solar year was but approximately known until within a few hundred years.

The length of the year as counted by the Julian calendar was too long by 11 minutes and 14 seconds, and this error amounted to ten full days in the 1,600 years from the time the Julian calendar went into effect, until the introduction of the Gregorian calendar.

A few years ago when visiting the Vatican Observatory, I was particularly interested in the Gregorian tower, which forms a part of the Vatican library building. After passing through a number of rooms which are used in connection with the observatory, when near the top of the tower, I was taken into the spacious and beautiful calendar room, the walls of which are covered with paintings of the highest order, executed centuries ago, under the direction of Pope Gregory XIII. In the center of the room, and forming a part of the floor, there was a large marble slab, on which was cut a fine line exactly in the true meridian, and upon the line was a special mark which indicated the altitude of the sun at noon of a certain day. On the south wall, near the top of the room, there was a small aperture through which the direct rays of the sun passed at noon, projecting a bright spot on the meridian line. All of this had been planned and executed by the astronomers in order that they might demonstrate the necessity of reforming the calendar, and when at noon on the 23rd of March, 1582, Pope Gregory saw that the altitude of the sun as shown by the beam of light, was not for that particular day, but for the day ten days previous, he directed that ten days be stricken from the calendar, and that day should be the 11th of March, instead of the 23rd.

With such precision had the astronomers determined the true length of the year, that our present calendar with its intercalations will continue on for 20,000 years, with an error not to exceed a single day.

The line on the marble slab and the aperture through the wall of the calendar room were devices simple in the extreme, and in this day of instruments such a method would hardly be considered, yet they served their purposes admirably, and the placing of that line on the true meridian, with an accuracy never before attained, was considered one of the greatest scientific achievements of that age.

The Evolution of the Clock.

Since an unknown time the day has been divided into twenty-four hours, and as civilization has advanced, the greater has been the necessity for the utmost precision in the measurement of each hour, with its subdivisions. The sun dial is not only the earliest, but the most interesting of all the numerous arrangements that have been devised for measuring the divisions of the day. Notwithstanding its limitations, it has been a subject which has attracted the brightest minds for ages. Within these later years there has been a renewed interest in this ancient timekeeper, not only in copying the types of dials, which are valuable because of their antiquity, but in working out new forms. Recently a new dial has been invented, by which the rays of the sun will indicate the true mean time for each day of the year, with an error not to exceed one minute.

The hour glass, which came later, was considered a much more practical method, inasmuch as it could be used either day or night and because its use was not confined to a particular location; however, as a timekeeper it was not satisfactory, even in those early days.

The clepsydra or water clock, which is supposed to have been invented by the Greeks, was found to be a much better time-keeper than either the sun dial or hour glass, and it was a great step in advance towards the accurate measurement of time.

These water clocks are to this day used extensively in the East, more especially in China. Those first used by the Greeks consisted of two water jars so arranged that the water from the upper ran into the lower, and the time of day was determined by measuring the depth of water in the upper jar, and at sunrise each day the water was returned to the upper jar. In the city of Canton there is a water clock which has been running for eight hundred years, and at the present time it is the standard clock of that city. This clock consists of four water jars, each having a capacity of eight or ten gallons. The jars are placed one above the other, in the form of a terrace, the three upper ones being provided with a small orifice near the bottom, through which the water drops into the jar next below, and so on down from one to the other, until the water reaches the lowest or registering jar. In this there is a float, to which is attached an upright, having graduations for the hours and parts of hours, and as the water rises the time can be determined by noting the height of the float in relation to the cross-bar at the top of the jar.

In this improved form of water clock the variation in the flow of water due to the difference in height is overcome by having a series of jars, the outlet of the upper being so graduated that there is but little variation in the height of

*President's address delivered at the New York meeting of the American Society of Mechanical Engineers, Dec. 6, 1904.

water in the second jar, and in the third the height remains practically uniform, thus insuring a constant head for the water which drops into the registering jar. At the beginning of each day the water is taken from below and carried up a flight of steps to the top. That such an arrangement has some elements favorable to the accurate measurement of time, there can be no doubt. It certainly has the element of simplicity, and notwithstanding its long service, the only wear noticeable was confined to the steps leading to the upper jar.

Clocks of the present type, although used as far back as the twelfth century and possibly earlier, were but fair time-keepers, until several centuries later. Those which the astronomers used in their observatories at the end of the fifteenth century, were so unreliable that modified forms of the clepsydras of the ancients were used, and as they did not prove to be satisfactory most of the observations were made without the use of clocks.

Galileo's beautiful discovery of the isochronism of the pendulum from the swinging chandelier in the church at Pisa, was of great value in many respects, but in none more so than in its application to the measurement of time. Soon after that great discovery the English clock-maker, Graham, invented the mercurial pendulum, by which the variation in its length caused by the difference in temperature was fully compensated, and some years later Harrison, another English clockmaker, invented a compensating pendulum, which consisted of a series of metal bars having different coefficients of expansion. So that two hundred years ago, as it is today, the pendulum was the nearest perfect of all the devices that have been employed for governing or controlling the motions of a clock mechanism.

Every part of the clock down to the minutest detail has been the subject of study and improvement, and they are made and adjusted with such precision and delicacy that in testing them the question is, within how small a fraction of a second will they run? Not content with their marvelous performance when under normal conditions, some of the finest astronomical clocks are surrounded by glass or metal cases, in which a partial vacuum is maintained. And in order that the cases may not be opened or disturbed, the winding is done automatically by means of electricity, the frequency of the winding in some cases being as often as once every minute. These clocks are set up in especially constructed rooms or underground vaults, where they are free from jar or vibration, where the temperature and barometric conditions remain practically constant, and where every possible precaution is taken to further minimize the errors of the running rate.

A clock in the observatory at Berlin has run for several months under these favorable conditions, with a rate having a mean error of but 10-1000 second per day and a maximum error of 30-1000 second per day. Another clock installed at the observatory of Case School of Applied Science at Cleveland, running under similar conditions, also has a mean error of 15-1000 second per day, with a maximum error for several months of but 22-1000 second per day. These are notable examples of the present state of the art of clock-making, and show the wonderful precision with which minute intervals of time can be measured.

From the time of the invention of Peter Hele, in 1477, of the "Nuremburg animated egg" or "pocket clock," which required winding twice a day, and varied an hour and a half in the same length of time, the development of the watch has kept pace with the "mother clock" and followed closely to it in time-keeping qualities.

These marvelous little machines, whether made at the homes of the peasants among the hills and mountains of Switzerland, where the skill required for making a single part has been handed down from generation to generation, or made in the great factories of this country, where fully 2,000,000 high-grade movements are turned out annually, and where the skill of the workmen has been supplemented by modern methods and machinery, are, notwithstanding the difficulties attending their manufacture, produced so cheaply as to be within the reach of almost every one.

Ship Chronometers.

The larger watch, or ship chronometer, with its escapement so delicately made and adjusted that it must always be kept in the same position, was greatly improved through the efforts of the British Government in 1714 by offering rewards of ten, fifteen and twenty thousand pounds to any who should make chronometers that would run so accurately that the longitude of a ship at sea could be determined within 60, 40 and 30 miles, and Harrison, the inventor of the compensating pendulum and the compensating balance, which is now used in watches, succeeded in making a chronometer, which, after being tested on a long voyage, was found to run so closely that the position of the ship was determined within 18 miles, and he was therefore paid the full award of twenty thousand pounds. That historic chronometer which marked a new era in navigation, is now numbered among the treasures of the Greenwich Observatory.

Modern ships are equipped with chronometers so accurate and so reliable, and with sextants of such precision that navigators can determine their position in latitude and longitude within a few miles. Therefore, with the increased speed of the powerful ships carrying hundreds or even thousands of passengers, together with their valuable cargoes, the methods and instruments used in navigation have been so improved as to greatly diminish the dangers in crossing the seas.

The perfection attained in the measurement of time, which is of such great practical value in nearly every sphere of life, would not have been possible were it not for the even greater refinements that have characterized the methods and instruments used by the astronomer in determining the length of the day and of the year, which are the fundamental standards of time.

The division of the circle and the measurement of angles has ever been among the unsolved problems of the astronomer, yet in the instruments used by him, circles have formed a most important part.

Fine Graduations of Circles.

Long before the telescope was invented, Tycho Brahe, the Danish astronomer, "the founder of Modern Astronomy," constructed for his observatory, instruments of various kinds having graduated circles and arcs of circles. His instruments for the most part were improvements on those used by Arabian astronomers in the eighth and ninth centuries, and these, in turn, were copied after similar instruments used by the Greeks and Egyptians, a thousand years previous, and it is supposed that such instruments were used by the Chinese at an even earlier period, so that graduated circles have come down to us from the far-off ages.

The longer the radius the more accurate the graduations, was the principle upon which the early instruments were made. The Arabians, in about the year 1000, built a sextant with a 60-ft. radius and a quadrant with a 21-ft. radius, but to Tycho Brahe is due the credit of constructing instruments having circles much smaller in diameter and graduated with a greater precision than ever before. It was by the use of such improved instruments of his own making, and by his observations which were made without a telescope or any means of magnification, that he was able to give the positions of a large number of stars within less than one minute of arc from the positions given by modern astronomers.

The graduation of an eight-ft. mural circle in 1725 by Graham of England, for the National Observatory, and of an eight-ft. quadrant by Bird, in 1767, were notable steps in advance in the division of the circle and the measurement of angles, but these and similar instruments, although their efficiency was greatly augmented by the use of the telescope, have been supplanted by others more practical.

Dividing Engines.

The first circular dividing engine was made in 1740 by Henry Hindley, of York, for cutting the teeth of clock wheels, and it is interesting to note that in the same year Huntsmann, another clock-maker, of Sheffield, invented the process of making crucible steel, that he might have a metal suitable for the springs of his clocks.

Of the several engines constructed later, the one most successful and representing the greatest progress, was that made by Ramsden, in 1777. This engine, automatic in its movements, was made especially for graduating circles, and because of the great precision with which he divided the circles of the instruments used by the government, the Board of Longitude awarded him the sum of six hundred and nfteen pounds. A further and most potent recognition of the excellence of his work lies in the fact that all subsequent circular dividing engines have followed closely the same general principles of construction embodied in the Ramsden engine.

It is most gratifying to all those who are interested in mechanical progress that the Ramsden engine has been preserved throughout all these years, and it now stands in the museum of the Smithsonian Institution, at Washington, as a monument to the one who made it, and as the best example of that time of the art of graduating circles.

Many excellent dividing engines have been made that are quite sufficient in point of accuracy for the work for which they were intended, but the perfection required in the graduation of circles for astronomical instruments, is such that it has been found to be one of the most difficult of all mechanical problems to make an engine that will meet such requirements. In such an engine the chief essential is that the spindle carrying the master-plate shall be as nearly round and as closely fitted in its bearings as is possible, for the degree of excellence with which that work is done determines how closely a circle can be divided.

It seems almost incredible that a well lubricated spindle of four inches in diameter at its largest part and tapering three-quarters of an inch to the foot, can be made so nearly round and so closely fitted in its bearings that a movement of 1-1000 inch in or out of its bearings will in one case cause it to turn with difficulty and in the other with perfect freedom, yet this has been found to be within the limits of mechanical refinements.

The greatest accuracy thus far attained in such engines, is one second of arc, which arc, with a radius of three miles equals one inch, and at twenty inches, which is the radius of the silver ring upon which the graduations on the master-plate are made, a line 1-1000 inch in width is equal to twelve seconds of arc, or twelve times the accumulated errors of any number of divisions, or twenty times the greatest error of any single division.

In automatically graduating a circle, it has been found to be impracticable to cut more than six lines in a minute, and it requires about 33 hours to divide a circle into two-minute spaces. As with the running of the finest clocks, the best results can only be obtained when the engine is surrounded with every favorable condition possible. Instead of the large circles and sectors used by the ancients, they have been made smaller in diameter as the methods for graduating have been improved, until those of the more modern instruments are seldom more than thirty inches, and some of the latest meridian instruments have circles of but 25 inches.

The smaller circles, which can be made and graduated with greater precision than the larger ones, are also less liable to change in form, owing to their weight and the variation in temperature, and with the aid of the reading microscope the results obtained would not be possible with the larger circles.

A twenty-five inch circle read with a microscope having a power of forty, would be equivalent to a circle of about eighty feet in diameter, and a single second of arc as seen through the microscope would be equal to 0.0024 of an inch, a quantity easily subdivided.

A most important adjunct to the astronomer's instrumental equipment, is the filar micrometer. With it he determines the errors of divisions, the eccentricity of his circle and measures the angles to within a fraction of a second; and when used at the eye end of the telescope he determines the positions and motions of the stars and the distances and diameters of the planets. In these little instruments, whether of the simple or complex form, the chief requisites are the screw and the cross wires, for upon them the value of the observations and measurements depend.

To make the screw of a micrometer so true that the errors in the threads cannot be detected by its own magnifying power, is an extremely difficult task. These micrometer screws are often made with one hundred threads to the inch, and are provided with graduated drums having one hundred divisions, the readings being made in tenths of a division.

Spider Lines in Micrometer Work.

The cross wires, which are but common spider lines, because of their fineness and the remarkable qualities they possess are indispensable in micrometric work. That the repulsive and even dangerous spider has plenty of enemies among the human family, there can be no doubt, yet if the value of the contributions which it has made to the cause of science were generally known, it would surely have a greater number of friends than at present, and most certainly the astronomer will say naught against it, for after the experience of many years he has found that the spider furnishes the only thread which can be successfully used in carrying on his work.

The spider lines mostly used are from one-fifth to one seventh of a thousandth of an inch in diameter, and in addition to their strength and elasticity, they have the peculiar property of withstanding great changes of temperature, and often when measuring the sun spots, although the heat is so intense as to crack the lenses of the micrometer eye-piece, the spider lines are not in the least injured. The threads of the silk worm, although of great value as a commercial product, are so coarse and rough compared with the silk of the spider that they cannot be used in such instruments. Platinum wires are made sufficiently fine, and make most excellent cross wires for instruments where low magnifying powers are used, yet as the power increases they become rough and imperfect.

Spider lines, although of but a fraction of a thousandth of an inch in diameter, are made up of several thousands of microscopic streams of fluid, which unite and form a single line, and it is because of this that they remain true and round under the highest magnifying power. An instance of the durability of the spider lines is found at the Allegheny Observatory, where the same set of lines in the micrometer of the transit instrument has been in use since 1859.

The placing of the spider lines in the micrometer is a work of great delicacy, and in some micrometers there are as many as thirty which form a reticule, with lines two one-thousandths of an inch apart, and parallel with each other, under the highest magnifying power.

Step by step from the methods of the Arabian astronomers to the time of Tycho Brahe and on down to the present day, improvements in the instruments and methods for the measurement of angles have been going on, until astronomers can measure double stars with a separation of one second of arc, and within less than one second they can define their positions in the heavens.

In the realm of the measurements of minute linear distances, and the perfection of curved and flat surfaces, the refinements are even greater than those pertaining to the measurement of time and of angles.

Most important in the linear dividing engine is the screw,

and although much had been accomplished in bringing such engines to a high degree of excellence, it was for Prof. Rowland to make an engine which has a practically perfect screw; and without doubt it is in all respects the nearest perfect of all the mechanisms that have been employed for ruling lines exactly parallel and equally spaced.

The Rowland engine was made especially for ruling diffraction gratings which are made of speculum metal, and with it a metal surface has been ruled with 160,000 lines, there being about 29,000 to the inch, and as many as 43,000 lines to the inch have been ruled.

The gratings mostly used have from 14,000 to 20,000 lines to the inch, and with such exactness is the cutting tool moved by the screw that the greatest error in the ruling does not exceed one millionth of an inch.

The production of these gratings, which has enabled the physicist in his study of the spectrum to enter fields of research before unknown, has not only called for the highest degree of perfection ever attained in the spacing of linear distances, but it has also called for a refinement most difficult in the optical surfaces upon which the lines are ruled. To Mr. Brashear was given the problem of producing such surfaces, and notwithstanding the many difficulties encountered in working and refining the speculum metal plates, he has made many hundred plates with surfaces either flat or curved with an error not to exceed one-tenth of a wave length of light, or one four-hundred thousandth of an inch.

Standardizing by Light Wave Lengths.

The established standard of length which are the yard of Great Britain and the meter of France, being made of metal, and liable to destruction or damage, Prof. Michelson conceived the idea of determining the lengths of these standards in wave lengths of light, which would be a basis of value unalterable and indestructible.

For the purpose of carrying out these experiments, the interferometer was constructed, an instrument which required the highest order of workmanship and the greatest skill of the optician. Again Mr. Brashear proved to be equal to the occasion, and made for the instrument a series of refracting plates, the surfaces of which were flat within one-twentieth of a wave length of light, with sides parallel within one second. This was the most difficult work ever attempted in the refinement of optical surfaces.

Professors Michelson and Morley devised a method for using the interferometer for making the wave length of some definite light an actual and practical standard of length. So satisfactory was the result that Prof. Michelson was invited to continue the experiments at the Bureau of Weights and Measures, at Sevres, France, where the standard meter, which is kept in an underground vault and inspected only at long intervals was used for that important work, which occupied nearly a year. The final result of the experiments shows that there are 1,553,164.5 wave lengths of red cadmium light in the French standard meter, at 15° C. So great is the accuracy of these experiments, that they can be repeated within one part in two millions. Should the material standard of length be damaged or destroyed, the standard wave length of light will remain unaltered, as a basis from which an exact duplicate of the original standard can be made. These two marvelous instruments, the Rowland dividing engine and the Michelson interferometer, show the possibilities in the perfection of linear divisions and the standards of length.

We have recounted some steps of the progress that has been made in the measurement of time, of angles, and of length, together with some of the refinements in these measurements; but we are confronted with the fact that notwithstanding all that has been accomplished from centuries past down to the present time, there are, as ever before, many imperfections requiring new problems in mechanical science to be worked out for the further enlightenment and welfare of mankind.

NEW BOOKS.

"Locks and Builders' Hardware" is the title of a book in which every man interested in art metal work will find much to delight him. The author is Henry R. Towne, president of the Yale & Towne Mfg. Co., and the dedication is to American architects "whose generous encouragement has aided every effort for the mechanical and artistic advancement of American hardware." Mr. Towne's wide acquaintance with members of the architectural profession and his long connection with the manufacture of builders' hardware make him preëminently the man to prepare such a work. The fact that it deals largely with the products of but one firm, as in the nature of things would be the case, does not detract from the representative character of the book. In the early chapters, which are largely historical, illustrations are given from all countries and from a variety of products. The narrative and historical section is made up of eight chapters, some of them being papers contributed to "A History of Architecture in New York." The chapter titles are: "Lock Making and Art Metal Working in America," "Artistic Hardware," "Artist and Artisan," "A Bit of History," "The Yale Lock," "Story of an American Industry," "Evolution in Lock Designing," and "Historical"—the last tracing in the most engaging way the development of the art of the locksmith. Lock picking is treated in a sketch of rare interest. "The Mechanics of Hardware" is another part of the work; then follows "Art Metal Work and Ornament," which ranges widely over the field of metal working in all countries and in all times. This section is made up chiefly of original papers by W. W. Kent, architect, and is illustrated profusely with historical subjects. Going into detail, the book then takes up in turn locks and latches, locks in sets, plain hardware, hardware groups and cabinet hardware. There are over 1,100 pages in the book. They are 5 x6¾ in., and are bound in flexible leather. The last 400 or 500 pages of the book apply specifically to the manufactures of the Yale & Towne Mfg. Co., and the articles described and the catalogue numbers used are all for the publications of that company. This gives a commercial stamp to the work, and prepares one for the 16 pages of advertisements of different companies that appear at the end. It is altogether a noteworthy contribution to the history of art metal working in the world. The publisher's imprint is that of John Wiley & Sons, New York, and the price of the book is $3.

Plans of the Wabash.

President Ramsey reports that the Wabash is enjoying good tonnage and that business prospects are bright. He added: "We expect shortly to award contracts for more cars and locomotives, but just how many I cannot say. During the past six months the railroads have placed orders for 40,000 wooden and steel cars and the car works have contracts on hand to keep them busy for the next four or five months. Contracts, which I placed some time ago, I could not duplicate now for less than 15 percent advance. If the rail manufacturers reduce the price of steel rails heavy orders will be placed by the railroads."

It is reported that the Bessemer & Lake Erie railroad is seeking an entrance into New Castle, Pa. The Carnegie Steel Co. operates four blast furnaces at this place and the ore shipments would amount to about 1,200,000 tons annually from Conneaut, O. In addition the tonnage of finished material from the tin mills at this place would be considerable.

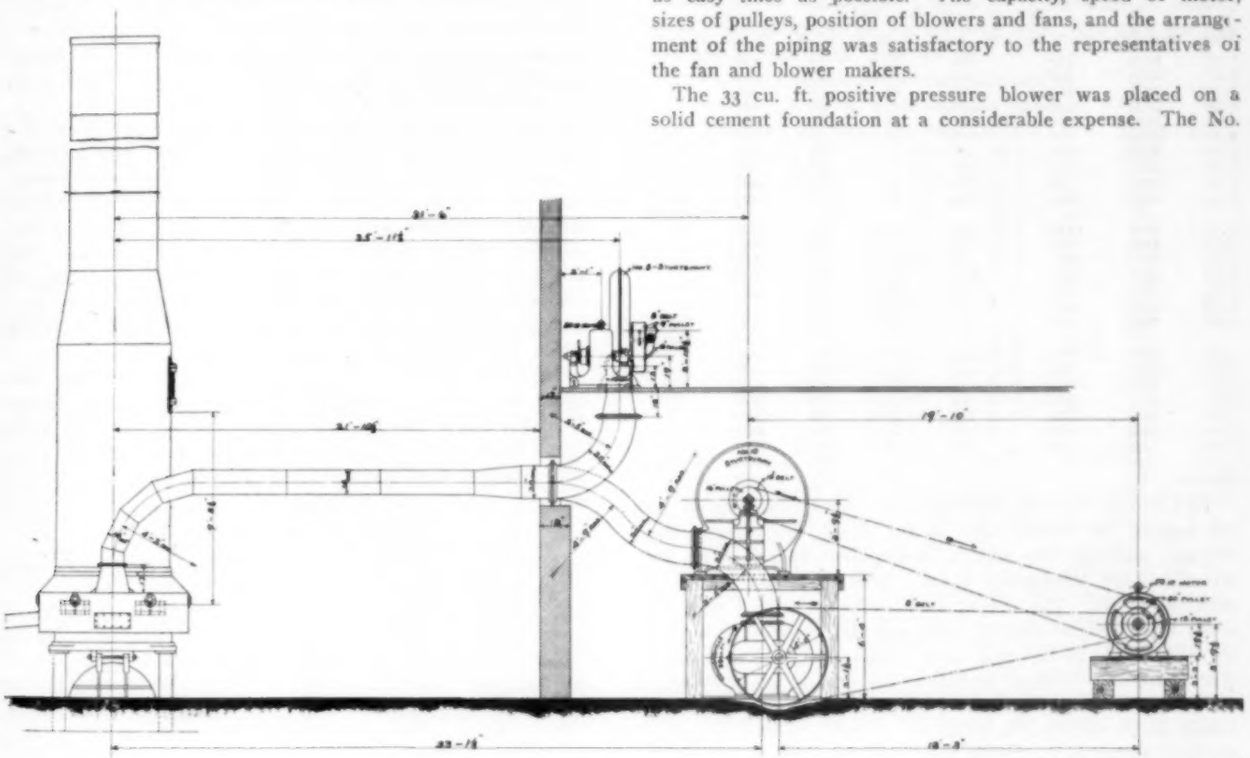
The Westinghouse Electric & Manufacturing Co. has been awarded the contract for all the electrical apparatus to be installed at the El Oro Mining & Railway Co., El Oro, Mexico. This contract amounts to nearly $100,000.

Fan and Positive Pressure Blower Tests.*

[Made at Ft. Pitt Foundry, Pittsburg, by W. H. McFadden, vice president and general manager Mackintosh, Hemphill & Co.]

BY H. E. FIELD, MET. ENG.

At the March 7 meeting of the Pittsburg Foundrymen's Association Thos. D. West presented a paper entitled "Fan Power for the Cupola." In this paper Mr. West gave his experience in installing a fan for cupola work. He included data which showed that it required a very much greater horsepower to run the fan than had been anticipated by the makers. He called attention to the fact that the data supplied by the fan builders made no mention of the horsepower required and contended that some data should be compiled showing the power used in running a fan with an open and closed outlet. This paper brought out a very spirited discussion regarding amount of horsepower required to run a fan blower and a positive pressure blower.



ARRANGEMENT OF FANS AND POSITIVE PRESSURE BLOWERS FOR TESTS MADE AT WORKS OF MACKINTOSH, HEMPHILL & CO.

A committee was appointed, as a result of this discussion, to investigate this question further. They sent out a list of questions to representative foundries, hoping that the answers would determine approximately what horsepower was being used to run a fan and a positive pressure blower. Interesting answers were received to these questions. Very few of them were complete, however, and it was impossible to obtain from them the information desired. These replies were tabulated and presented to the association at a subsequent meeting. The contradictory results reported in these answers were very unsatisfactory to the committee and Mr. W. H. McFadden, a member of the committee, volunteered to have a test made at the works of Mackintosh, Hemphill & Co. He contended that, in order to get a true comparison, tests should be made under exactly the same conditions. Inquiries were sent out to different fan and blower makers for fans and blowers to be used in the test. The Connersville Blower Co., Connersville, Ind., and the B. F. Sturtevant Co., Hyde Park, Mass., very kindly agreed to supply a positive pressure blower and a fan blower, respectively, for the test.

*Presented at the meeting of the Pittsburg Foundrymen's Association, Dec. 5, 1904.

Construction.

The size of the cupola, together with other necessary data, was supplied to each, and the selecting of the blowers, pulleys, etc., was left to them. They were asked to have their representative present at the test, and both sent their mechanical engineer. The Westinghouse Electric & Mfg. Co. furnished a motor for the test, and supplied an engineer to take the readings. Mr. S. H. Stupakoff furnished a pyrometer and took the readings. J. & H. Phillips furnished the belts. The cupola used was 54 in. inside the lining. The piping and wind box were new and were installed by Mackintosh, Hemphill & Co. for the test. Leakage was reduced to a minimum. The positions of the blower and fan are shown in the accompanying sketch. Every precaution was taken to do away with bends and elbows and wherever one was necessary it was made on as easy lines as possible. The capacity, speed of motor, sizes of pulleys, position of blowers and fans, and the arrangement of the piping was satisfactory to the representatives of the fan and blower makers.

The 33 cu. ft. positive pressure blower was placed on a solid cement foundation at a considerable expense. The No. 10 fan was placed on a heavy oak platform directly over the blower. They were so arranged in order to save room and piping and to eliminate one bend in the pipe for fan connecting. It was necessary to have one extra elbow in the blower connection. The pipes enter the cupola at the top of the wind box on opposite sides of the cupola. The pipe was No. 10 riveted and was guaranteed air tight by the makers. A water column pressure gauge was used for taking pressure and was attached to the wind box of the cupola.

Speed of Motors and Blowers.

The same motor was used for both tests (a 50-h. p., 220-volt, shunt-wound, rated at 825 r. p. m.). For the blower test, it was run at an average speed of 819 r. p. m. and for the fan test at a speed of 839 r. p. m. For the fan test the motor was equipped with a 30-in. pulley and the fan was fitted with a 16-in. diameter, 15-in. face pulley. The B. F. Sturtevant Co. had previously notified us that they desired to run the fan at from 1,500 to 1,550 revolutions. The blower was

equipped with a 60-in. pulley, 15-in. face, and the motor was fitted with a 12½ in. pulley.

First Test. No. 10 Sturtevant Fan.

The first test was made Oct. 17, 1904. The blast was supplied by the No. 10 Sturtevant fan. The fan was connected as shown in the sketch. The readings on the volt and ammeter were taken by an engineer from the Westinghouse Electric & Mfg. Co. Mr. Stupakoff took temperature readings on a Le Chatelier pyrometer.

Sixty thousand seven hundred (60,700) lb. of metal were charged into the cupola. One half scrap and one half pig was used, as being a fair representative of ordinary foundry practice. Fifteen hundred (1500) lb. of coke were charged on bed, followed by 4,500 lb of iron. The balance of the heat was made up of 4,000-lb. charges, with 450 lb. of coke to the charge. The last charge was 4,200 lb. of iron.

Readings were taken every ten minutes, the pressure at the cupola being taken at the same instant as were the readings at the motor. Table No. 1 gives a condensed record of this heat.

TABLE NO. 1. FIRST HEAT, OCT. 17.
No. 10 Sturtevant Fan.

Time.	Pressure	No. Volts.	No. Amp.	E. H. P.	H. P.	Speed.	Temp.
2:02	12½	212	145	41.2	36	840	
2:10	12½	208	155	43.2	38.5	844	
2:20	12⅞	215	148	42.6	38	840	
2:30	12⅞	216	144	41.7	37	845	
2:40	13⅛	216	132	38.2	33.5	850	
2:50	13½	220	128	37.7	32.5	840	
3:00	13⅛	218	130	38	33	840	
3:10	13	218	128	37.4	32.5	825	
3:20	13¼	218	120	35.1	30.5	840	
3:30	13½	220	126	37.2	32.5	845	2185° (ladle)
3:40	13¾	216	125	36.2	31.5	830	
3:50	13¾	220	115	33.9	30	845	
4:00	14	217	123	35.8	31	847	
4:10	14	217	112	32.6	28	845	
4:20	14	219	112	32.9	28.5	837	
4:30	14⅛	217	110	32.0	27.5	840	
4:40	13¾	217	105	30.5	25	833	2150° (ladle)
4:50	13¾	214	105	30.1	25	832	
5:00	13¾	214	110	31.5	26	830	
5:10	13⅞	218	110	32.1	27.5	838	
5:20	14	219	110	32.3	28	838	
5:30	14	220	115	33.9	30	840	
5:40	13¾	220	120	35.4	31	840	
5:50	13¾	219	130	38.2	33.5	837	
Average	13.6			35.8	31.2	839	

This shows the time readings were taken, the pressure at the cupola, the temperature of the metal, the current and voltage, readings, the electric horsepower figured from the latter and the horsepower figured from the curve furnished with the motor. The temperature of the metal was taken in order to determine whether there was any decided difference in temperature of the iron melted with the fan and blower. The material charged, including coke, was all accurately weighed. The melted iron was weighed as it came from the cupola and is recorded in Table No. 2, which gives a record of the iron melted as each ladle was taken from the cupola.

TABLE NO. 2. FAN HEAT, OCT. 17, 1904.

	Time.	Time taken.	Amount melted.
Wind on	2:02		
First tap	2:23	23 min.	
First ladle out	3:38	1 hr. 36 min.	27,630
Second ladle out	4.39	1 hr. 1 min.	14,750
Third ladle out	5:10	31 min.	6,000
Fourth ladle out (bottom drop)	5:48	38 min.	7,800
Amount taken out in shanks			700
Amount left in cupola			800
Total amount melted iron			57,680

Figuring from the above data, we find that the heat lasted 3 hr. 46 min. The average amount of iron melted per hour, based on iron melted, was 15,312 lb., or 7.65 tons. During the first part of the heat, the cupola melted at the rate of 17,200 lb. per hour. In the middle of the heat, it was melting at the rate of about 15,000 lb. per hour, while at the end of the heat it was melting but 12,200 lb. per hour. This decrease in the rate of melting was due to the fact that the tuyeres became partly closed up at the end of the heat; consequently, less wind was supplied by the fan. This data are included in Table No. 3.

TABLE NO. 3. FAN BLOWER HEAT, OCT. 17, 1904.

Total time of heat	3 hr. 46 min.
Average amount melted per hr. based on iron charged	16,116 lb. (8.06T)
Average amount melted per hr. based on iron melted	15,312 lb. (7.65T)
Rate of melting, first of heat, based on iron melted	17,262 lb. (8.63T)
Rate of melting, middle of heat, based on iron melted	15,000 lb. (7.5 T)
Rate of melting, end of heat, based on iron melted	12,230 lb. (6.12T)

From table No. 1 we find that the average electric horsepower consumed would be approximately 35.8. The heat lasted 3.76 hours, so that the total e. h. p. consumed was about 134.8. The amount charged was 30.35 tons. The e. h. p. hours per ton charged would consequently be 4.41 and the k. w. hours per ton charged would be 3.29. From these data, with the cost per k. w. h. known, the exact cost of power for the heat can be figured.

TABLE NO. 4.

Total length of heat	3 hr. 46 min. (3.78hr.)
Average horsepower consumed by motor	35.8
Total e. h. p. hours for heat	134.8
Number of tons charged	30.35
Number e. h. p. hours per ton charged	4.41
Number k. w. hours per ton charged	3.29
Number tons melted	28.84
Number e. h. p. hours per tons melted iron	4.67
Number k. w. hours per ton melted iron	3.41

Second Test. 33 cu. ft. Connersville Blower.

The second test made Oct. 19, 1904. A 33-cu. ft. Connersville blower was used to supply the blast. The conditions prevailing during this heat were the same as governed the test on the Sturtevant fan on the 17th. The same motor was used; the proportion of pig iron to scrap was identical; the cupola was charged in a like manner and the scrap selected was of a similar grade to that used in the previous test. The difference in piping is readily observed in the sketch. Sixty-three thousand lb. (63,000) instead of 60,700 were melted. Fifteen hundred lb. of coke were used on the bed and 4,500 lb of iron were charged on the first charge. There were 450 lb. of coke and 4,000 lb. of iron in the next fourteen charges. On the 16th charge, 300 lb. of coke were used to 2,500 lb. of iron. This proportion of coke to iron gave a ratio of about 1 to 8, which is a fair average of foundry practice.

Table No. 5 gives a record of the time the readings were taken, the current and voltage, the electric horsepower, figured from the same, and the horsepower figured from the curve sent with the motor. The speed of the motor and the pressure readings were taken at identically the same time as were the volt and ammeter readings.

TABLE NO. 5. TEST HEAT, OCT. 19.
33 cu. ft. Connersville Blower.

Time.	Pressure.	No. Volts.	No. Amp.	E. H. P.	H. P.	Speed.	Temp.
2:00	10½	224	80	24.0	19	825	
2:10	14¾	217	110	32.0	28	830	
2:20	14	218	108	31.4	26	830	
2:30	16½	218	118	34.5	30	835	
2:40	18½	218	130	38.0	32.5	835	
2:50	21¾	216	150	43.4	39	830	
3:00	23¼	214	152	43.6	39	810	
3:10	23	215	152	43.8	39	810	
3:20	23½	212	152	43.2	38	810	
3:30	23½	214	155	44.4	40	812	2165° (ladle) 1st
3:40	25	212	156	44.3	40	815	
3:50	24	216	160	46.3	41	815	
4:00	24	214	165	47.3	42.5	820	
4:10	25	210	177	49.8	45	815	2175° (ladle) 2d
4:20	24½	212	170	48.3	43.5	816	
4:30	20¾	214	145	41.6	36.5	830	
4:40	19½	214	140	40.2	35	830	
4:50	19½	215	123	35.4	30.5	780	
Average	20⅝			40.6	35.8	819	

Table No. 6 gives a record of the iron as melted.

TABLE NO. 6. CONNERSVILLE BLOWER HEAT, OCT. 19, 1904.

	Time.	Time taken.	Amount melted.
Wind on	2:00		
First ladle out	3:33	1 hr. 33 min.	31,800
Second ladle out	4:05	32 min.	12,100
Third ladle out	4.28	23 min.	6,620
Fourth ladle out (bottom drop)	4:49	26 min.	6,950
Taken out in shanks, left in cupola, etc.			2,207
Total amount melted iron			59,677

The total time consumed was, therefore, 2 hr. 49 min. The average melting per hour figured on the amount charged was 22,368 lb. (11.2 tons). The average per hour figured on the amount melted iron was 10.6 tons. During the first of the heat the iron was melted at a rate of 20,500 lb. per hour; during the

middle of the heat, at the rate of 22,300 lb. per hour; during the last of the heat, at the rate of 17,700 lb. per hour. These data are included in Table No. 7.

TABLE NO. 7. BLOWER HEAT, OCT. 19, 1904.

Total time of heat	2 hrs. 49 min.
Average amount melted per hr. based on iron charged	22,368 lb. (11.2T)
Average amount melted per hr. based on iron melted	21,186 lb. (10.6T)
Rate of melting, first part of heat, based on iron melted	20,580 lb. (10.2T)
Rate of melting, middle of heat, based on iron melted	21,400 lb. (10.7T)
Rate of melting, last of heat, based on iron melted	17,718 lb. (8.9T)

From Table 5 we find that the e. h. p. taken by the motor was 40.0. The heat lasted 2 hr. 49 min., consequently the total e. h. p. consumed was 114.49 h. p. h. 31.5 were charged, so that the e. h. p. h. per ton charged would be 3.63 and the k. w. h. per ton charged would be 2.71. These data are included in Table 8.

TABLE NO. 8. BLOWER HEAT, OCT. 19, 1904.

Average e. h. p. supplied to motor	40.6
Total e. h. p. hours for heat	114.49
Number of tons charged	31.5
E. h. p. hours per ton charged	3.63
K. w. hours per ton charged	2.71
Number tons melted iron	29.8
E. h. p. hours per ton melted iron	3.84
K. w. hours per ton melted iron	2.86

TABLE NO. 9.

Date.	Oct. 17.	Oct. 19.	Oct. 22.	Nov. 16.
Blower.	No. 10. Sturtevant.	33 cu. ft. Connersville.	33 cu. ft. Connersville.	No. 8. Sturtevant.
Tons charged	30.35	31.5	32.	31.
Tons melted	28.84	29.8	30.08	28.81
Tons iron charged per hr.	8.06	11.2	10.9	10.07
Tons iron melted per hr.	7.65	10.6	10.2	9.40
Number of hours run	3.77	2.82	2.93	3.08
Average e. h. p. (motor)	35.8	40.6	36.3	34.6
Average h. p. (from curve)	31.2	35.8	31.55	
H. p. h. per ton charged	4.41	3.63	3.32	3.43
K. w. h. per ton charged	3.29	2.71	2.47	2.68
H. p. h. per ton melted	4.67	3.84	3.53	3.70
K. w. h. per ton melted	3.41	2.867	2.63	2.76
Av. speed of motor in r. p. m.	839	819	756	1102
Av. speed of blower in r. p. m.	1557	171	151	2204
Average pressure in ounces	13.6	20.6	20.75	12.5
Ratio of coke to iron	1—7.82	1—7.78	1—7.9	1—8

In Table 9 I have included data on both tests.

Comparisons.

If we examine this table, we will note that in the two tests which we will call official, the average e. h. p. for the fan was 35.8 while the average for the blower was 40.6. The highest h. p. required by the fan was 43.2 against 48.3 for the blower. If, however, we note the total horsepower consumed, we will see that the fan consumed 134.8 h. p. h. for 30.35 tons while the blower required but 114.49 h. p. h. for 31.5 tons. This shows 4.41 h. p. h. per ton of iron charged for the fan and 3.63 h. p. h. per ton of iron charged for the blower; a difference of .78 h. p. h. in favor of the blower. The difference in time of melting the two heats was 57 minutes in favor of the blower. This would allow the user of the blower to postpone putting on the blast about one hour longer for a 30-ton heat. The saving thus made would depend upon the class of work and the number of men employed. Against these advantages in favor of the blower may be set the lower original cost of the fan, the lower cost of installation, and the fact that the high pressure of the blower test was much more severe on the lining of the cupola.

The fan blower makers claim a saving in repairs and in wear over the positive pressure blower, while the makers of the latter call attention to the great wear and slipping of the belts due to the high speed at which the fan runs. These are points that cannot be settled in a two days test.

The results of these tests show:

1. Under the conditions existing in the test, it took 4.8 less horsepower to run the fan that it did the blower.

2. That to melt a 30-ton heat, it took 23.4 less h. p. h. with the blower than with the fan.

3. That it took approximately one hour longer for a 30-ton heat when the fan was used than when the positive pressure blower supplied the blast.

4. That the temperature of the metal was approximately the same for the two heats.

5. That the blower caused a much greater wear on the lining of the cupola than did the fan.

Note.—In comparing these records with other tests, it should be remembered that very heavy scrap was used and the records obtained should not be compared with a cupola melting light scrap. This difference in the weight of the scrap makes a large difference in the speed of melting in a cupola, as will be shown in the latter part of this paper.

SUPPLEMENTARY TESTS.

In examining the data obtained from the two previous heats, I was convinced that the results obtained in the blower tests could be improved in economy by running the blower at a slower speed. To prove this, another heat was run Oct. 22. While this heat cannot be said to be official, the data should be of interest to this association. The readings were taken by our own electrical engineer Mr. Jas. F. Tracy, and all the care observed in the previous heats was observed in this one.

Third Test. Connersville Blower, Oct. 22, 1904.

In a third test, the pulley on the motor was reduced to 12 in. and the motor was run at a speed of 756 revolutions, instead of 819 revolutions, as in the previous heat. The data for this test will be found in Table No. 10.

TABLE NO. 10—TEST HEAT, OCT. 22.

33 cu. ft. Connersville Blower.

Time.	Pressure.	No. Volts.	No. Amp.	E. H. P.	H. P.	Speed.	Temp.
12.15	11	225	80	24.1	20	760	.....
12.25	11¾	225	92	27.7	23.5	770	.....
12.35	12½	225	76	22.9	17.5	770	.....
12.45	15	225	90	27.1	25	765	.....
12.55	16¾	220	100	29.5	25	765	.....
1.05	19½	220	110	32.4	28	750	.....
1.15	22¼	210	125	35.2	30	745	.....
1.25	22¾	225	130	39.2	35	750	.....
1.35	25¼	218	145	42.4	37.5	750	.....
1.45	24¾	210	145	40.8	35.5	750	.....
1.55	25	214	140	40.2	35	750	.....
2.05	25	218	145	42.4	37.5	750	.....
2.15	25½	216	150	43.4	38.5	760	.....
2.25	26	210	155	43.6	38.5	760	.....
2.35	26	216	155	44.9	40	770	.....
2.45	26	216	155	44.9	40	760	.....
2.55	21¼	220	130	38.3	34	770	.....
3.05	20½	220	125	36.8	32	780	.....
3.15	18¾	220	112	33.3	29	780	.....
Average	20¾	218	124	36.3	31.55	756	.....

It will be noted that average pressure was approximately the same as in the previous heat, but that the average e. h. p. was decreased from 40.6 on the 19th to 36.3 on the 22d. To be sure, the time for the heat was slightly prolonged but the total number of h. p. h. consumed was decreased from 114.49 to 106.36. The writer believes that a still further decrease in the amount of air supplied would have shown a greater economy in the e. h. p. consumed. The motor was run, however, at the slowest speed; the pulley on the motor was as small as it was possible to use and it did not appear to be practical to use a larger pulley on the blower. It would have been necessary to instal a slower speed motor to carry the investigation any further. Under the conditions, this was not practical. Further data in connection with this heat will be found in Table 11.

TABLE NO. 11. CONNERSVILLE BLOWER HEAT, OCT. 22, 1904.

Wind on	12:14		
First tap	12:38		
All melted (2 hrs. 56 min.)	3:10	59,160	
Left in cupola		990	
Total amount melted		60,150	
Rate of melting per hour (iron charged)		21,816	(10.9 tons)
Rate of melting per hour (iron melted)		20,502	(10.2 tons)
Total e. h. p. hours		106.36	
E. h. p. hours per ton iron charged		3.32	
K. w. hours per ton iron charged		2.47	
E. h. p. hours per ton iron melted		3.53	
K. w. hours per ton iron melted		2.63	

For a comparison of this heat with the two previous heats see Table 9.

Fourth Test.

We observed in our regular heats that better results were obtained with our old No. 8 Sturtevant fan that was shown in the test with the No. 10 fan. In order to ascertain exact figures for comparison, a further supplementary heat was run Nov. 16, using the No. 8 Sturtevant fan, arranged as

shown in the sketch. This test cannot be used as a direct comparison with the others, as it was taken at a different time and the conditions necessarily varied. This fan had been used in our work for several years. The motor was a 30-h. p. Westinghouse motor and was run at an average speed of 1,100 r. p. m. Piping was new and air tight. There was one more bend in the pipe than when the No. 10 fan was tested. The readings were taken by our electrical engineer. Exactly the same conditions were observed as prevailed in the previous heats. One half pig and one half scrap was used in making up the charges. The same method of charging was observed and a ratio of 1 of coke to 8 of iron was maintained. The chief difference between this heat and the three previous was in the scrap. In the three previous heats, all the scrap used was heavy scrap in such shape as to pack closely in the cupola. In the last heat, there was a small amount of very light scrap used, which tended to keep the cupola open. The result of this will be noted in the reading found in Table 12.

TABLE NO. 12. TEST HEAT, NOV. 16. DATA—NO. 8 STURTEVANT FAN.

Time.	Pressure.	No. Volts.	No. Amp.	E. H. P.	Speed.	Temp.
1:45	11	218	115	33.6	1100	.....
1:55	10⅞	214	128	36.7	1100	.....
2:05	11¾	220	130	38.3	1100	.....
2:15	12½	220	130	38.3	1100	.....
2:25	12⅝	220	126	37.2	1100	.....
2:35	12⅞	220	125	38.8	1100	.....
2:45	17⅛	220	125	36.8	1100	.....
2:55	12⅛	218	120	35.1	1100	.....
3:05	12½	220	115	33.9	1100	.....
3:15	13⅛	220	115	33.9	1120	.....
3:25	12¾	220	115	33.9	1100	.....
3:35	12½	220	112	33	1100	.....
3:45	13⅛	218	110	32.4	1100	.....
3:55	13½	218	110	32.1	1120	.....
4:05	13¼	218	110	32.1	1100	.....
4:15	13⅛	216	110	31.5	1100	.....
4:25	12½	216	115	33.3	1100	.....
4:35	12¾	220	115	33.9	1100	.....
4:45	11⅞	...	...	....	....	.....
Average	12½			34.6	1102	

The material charged and the melted iron were weighed, as in previous heats. The temperature of the iron was not taken, but it came good and hot all through the heat. The record of this heat will be found in Table 13.

TABLE NO. 13. NO. 8 STURTEVANT FAN HEAT, NOV. 16.

Wind on	1:43	
First ladle out	2:30	12,360
Second ladle out	3:00	10,600
Third ladle out	3:22	7,150
Fourth ladle out	3:47	7,720
Fifth ladle out	4:26	11,850
Sixth ladle out	4:48	6,790
Taken out in shanks and left in cupola		1,160
Total amount melted		57,630 (28.81 tons)

It will be noted from the above that the cupola melted very uniformly throughout. The average melting per hour per ton charged was 10.07 tons and the average melted iron tapped per hour was 9.41 tons. From 1.43 to 3.22, (1 hr, 39 min.), 30,110 lb. were melted, or a rate of 9.1 per hour for the first hour. In the middle of the heat, the iron was tapped at a rate of 9-½ tons per hour and, at the end of the heat, it was tapped at a rate of 9.3 tons per hour. This shows the uniform melting mentioned above. Table 14 gives the above data and Table 15 gives horsepower, etc., figured from two previous tables.

TABLE NO. 14.

Average amount melted per hr. based on iron charged	10.07 tons
Average amount melted per hr. based on iron melted	9.41 tons
Rate of melting first of heat based on iron melted	9.1 tons hr.
Rate of melting middle of heat based on iron melted	9.5 tons hr.
Rate of melting last of heat based on iron melted	9.4 tons hr.

TABLE NO. 15. NO. 8 STURTEVANT FAN HEAT, NOV. 16, 1904.

Average horsepower consumed by motor	34.6
Total e. h. p. hours for heat	106.56
H. p. hours per ton charged	3.43
K. w. hours per ton charged	2.68
H. p. hours per ton melted	3.70
K. w. hours per ton melted	2.76

This test shows a much lower e. h. p. than when the No. 10 fan was used. It will also be noted from the tables that the average pressure was somewhat lower. The e. h. p. in heat of Oct. 17th varied from 43.2 as a maximum to 30.1 as a minimum, a difference of 13.0 e. h. p. The heat on Nov. 16 varied from 38.8 to 31.5, a difference of but 7.3 e. h. p. This indicates a greater decrease in outlet in the first instance than in the second. In foundry parlance, we would say that the cupola became "bunged up" in the first instance. The rate of melting shows a decrease in the first heat, while in the latter heat, the melting rate was practically constant. The reason for this is probably due to the fact that the latter heat was kept open by a mixture of some light, open scrap.

A comparison of this heat with the three previous ones will be found in Table No. 9.

Conclusions.

It is not my intention to draw any definite inferences as to the relative efficiency of the fan and the blower for cupola practice. I have endeavored rather to record the data in as complete a manner as possible. There are, however, a few points which should be brought out to make the report complete.

1. The test has proven that, under favorable conditions, a 40-h. p. motor is sufficient to supply power for a blower or fan furnishing blast for a 54-in. cupola.

2. The rate of melting is not proportional to the amount of air supplied to cupola. Too much air will tend to cool the cupola around the tuyeres and thus reduce the melting area.

3. In a 54-in. cupola, when all heavy scrap and pig was charged, the 33 cu. ft. positive pressure blower melted more economically and faster than did the No. 10 fan blower.

4. The No. 8 fan melted much more economically and faster when the cupola was kept open by a small amount of light scrap, than did the No. 10 fan when all heavy scrap was used.

5. The high pressure produced by the positive pressure blower has a much more severe cutting effect on the lining than had the lower pressure produced by the fan blower.

6. The original cost and the cost of installation of the positive pressure blower would considerably exceed that of the fan blower.

7. The actual saving in horsepower is not a large item. The saving due to the shorter time taken by the blower would depend upon the number of men employed and the price of work.

8. The difference in economy between the two types of blower depends largely upon the cupola practice. The above tests would indicate that where the tuyeres were kept clean and the cupola was not packed too tight there would not be any great difference in favor of either of the types of blowers. If the tuyeres are allowed to become partly closed, the positive type would prove the better.

Addenda.

There are two or three admitted facts that should be borne in mind in the above report.

1. In order to obtain economical results in the fan blower, all curves should be avoided as much as possible and, when necessary, should be made on easy lines.

2. A fan delivers only as much air as there is a free opening for it to pass through. The horsepower required to operate the fan decreases as the free outlet closes.

3. A positive pressure blower must supply a given amount of free air per revolution. As the opening decreases in the cupola due to closing up of the tuyeres, etc., the positive blower will force the same amount of air through this opening as it previously forced through the larger opening. It will require, however, a much larger amount of power to accomplish this.

4. The pressure of air at a cupola, as recorded on a pressure gauge, is of value for comparisons only. The number of revolutions per minute of the positive pressure blower and the amount of horsepower consumed by the fan blower are the only guides to the amount of air supplied to the cupola.

The Lebanon Foundry Co., Lebanon, Pa., has passed into the control of a new company organized by New Yorkers, the change taking place Dec. 1.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market and Some of Their Wants:—

The Torris-Wold Co., Chicago, has been incorporated with a capital of $100,000, to manufacture machinery. Incorporators are: H. H. Lyche, Arthur W. McGovern and Johan Waage.

The Charles J. Nauen Loom Co., Paterson, N. J., has been incorporated with a capital of $125,000, to manufacture and sell machinery. Incorporators are: Edward J. Dixon, J. George Heck and Emma Mauen.

The New York Domestic Pumping Engine Co., New York City, has been incorporated with a capital of $15,000. Directors are: William Kirk, Frederick Cleveland and G. F. Hare.

The Landy Steel Range Co., St. Louis, Mo., has been incorporated with a capital of $20,000. Incorporators are: Joseph S. Landy, Edward Sudholdt and Benjamin F. Heil.

The New York Pneumatic Tube Co., New York City, has been incorporated with a capital of $10,000. Directors are: G. W. Mack, J. A. Blanchfield, of New York City, and G. W. King of East Orange, N. J.

The Avery-Caldwell Mfg. Co., Bellaire, O., is in the market for machinery for the manufacture of elevator buckets, steel barrels, shop racks, carrying trucks, etc.

The Seamless Bath Tub Co. has been organized at Detroit with a capital of $600,000, to manufacture a tub of one piece of steel, the invention of Eugene H. Sloman. The tub is covered with poreclain. The company expects to turn out not less than 10 tubs a day, and will require from three to five acres of ground for the plant which it expects to erect. The stockholders are: R. A. Alger, F. H. Walker, Joseph Boyer, George H. Barbour, George H. Russel, Walter S. Russel, Henry Russel, George B. Russel, Bryant Walker, H. B. Ledyard, Antonio C. Pessano, T. H. Bowles, H. M. Campbell, A. E. F. White, Ryerson Ritchie, William Stevens, Fremont Woodruff, C F. Berry, E. L. Ford, N. D. Carpenter, Peter White, Theo. D. Buhl, J. C. Hutchins, A. B. du Pont, Dewitt Loomis and Eugene H. Sloman.

A company has been organized at Waukesha, Wis., to make expanded metal lath, and ground has already been broken for the new plant. S. B. Harding, of Waukesha, will be manager. The corporation will be known as the Waukesha Expanded Metal Co.

The Standard Safe Co., Buffalo, N. Y., has been incorporated with a capital of $25,000, nearly all of which has been paid in. The directors are: Nathan Cohen, of Erie, Pa.; Mose Cohen, Buffalo, and Aaron Fybush, Buffalo. The company will start business in Buffalo at once, negotiations for a plant being now under way.

The Stadium Co., of New York, has been incorporated with a capital of $1,500,000 for the purpose of manufacturing machinery used in the operation of places of public amusement. The directors are: Max Rosen, Floyd C. Thompson, Myer Nussbaum, Gates Hamburger and William Bodge, of New York, and John F. Calder and Joseph P. Coughlin, of Albany.

The Reliance Iron & Engine Co., Racine, Wis., has been incorporated with a capital of $25,000.

The Globe Foundry Co., Port Chester, N. Y., has been incorporated with a capital of $40,000. The incorporators are: John F. Mills, H. L. Marshall, Thomas Fitzgerald.

The A. Worth Machine Co., Joplin, Mo., has been incorporated with $2,500 capital. The incorporators are: Cyntha J. Worth, A. Worth and A. J. Malone.

The Marion Malleable Co., Marion, O., has been incorporated with a capital of $40,000. The incorporators are: Henry S. Hane, B. F. Waples, James F. Prendergast, Charles C. Fisher and Willis L. Warner.

A. J. Moser & Co., Berne, Ind., have been incorporated with a capital of $17,500 to buy and sell threshing machines and saw mills, and repair boilers and engines, also to do plumbing and make gas fittings.

Fires and Accidents:—

In the fire at the plant of the Home Stove Works, Chicago, Dec. 1, two men were seriously injured, and damage amounting to $35,000 was done.

An explosion at the plant of the Chapin mine, Iron Mountain, Mich., Nov. 28, set the engine house on fire and all the compressed air used to operate the machinery was shut off. The damage is estimated at $6,000. The mine is equipped for cases of emergency with engines and boilers so that it has been possible to resume work with little delay.

The Friedley & Voshardt Steel Casting Plant at 194-202 Mather street, Chicago, was damged by fire Nov. 26 to the amount of $20,000.

New Construction:—

The Worth Bros. Co., Coatesville, Pa., has been laying its lines for increasing the capacity of its tube works, but has not yet done very much active work in that direction. It is probable, however, that the company will promptly proceed with the erection of at least one furnace, though more with the idea of keeping it in reserve while one of the present furnaces may be undergoing repairs or re-building, thus permitting the maintenance of a uniform output, rather than to increase the capacity of the plant.

The Blanchard Machine Co., Boston, Mass., whose plant was recently burned, is planning to erect a new shop at Cambridgeport, Mass. The building will provide 12,000 square feet of floor space on two floors.

The Day-Ward Co., Warren, O., whose foundry was recently destroyed by fire, expects to rebuild, but cannot at present give the exact dimensions of the plant, which will probably be of steel construction.

The Chicago Malleable Castings Co., West Pullman, Chicago, has begun the erection of a large modern pattern vault. The building will be equipped with metal clad doors and windows, with concrete roof, and windows of wired glass. The dimensions will be 40x80 ft.

Improvements which have been made at a cost of more than $40,000 at the plants of the Kitselman Bros., wire fence manufacturers, Muncie, Ind., have just been completed. Over $25,000 has been expended on the wire mill. The gas engines were discarded and steam engines installed. All of the furnaces have been overhauled so that either coal or gas can be used. A new galvanized wire furnace will be installed in a few weeks. This furnace will necessitate the increase of the number of employes to almost double what it has been.

The Davis Car Foundry Co. has purchased a tract of five and a half acres at Grayslake, Ill., and ground has been broken for the erection of a new plant, 100x250 ft.

The Delphi Commercial Club, Delphi, Ind., has signed contracts with the Delphi Machine Co., for the erection of a stone building two stories, 30x60 ft. The Commercial Club gives the company the land and $1,400 in money on condition that the company operates a machine shop for seven years.

H. B. Underwood & Co., Philadelphia, manufacturers of special tools for railway repair shops, will build an addition which will increase the floor space about 4,000 square feet.

The Boyne City Charcoal Iron Co., Marquette, Mich., has blown in its plant at Boyne City, Mich. The stack was originally built at St. Ignace, Mich., and was known as the Martel furnace. The company used the machinery from the abandoned furnace in building the new plant. The stack is 60x10½ ft. and is equipped with two Kloman firebrick stoves, each 60x15½ ft. The charcoal will be supplied on a long term contract by the Boyne City Chemical Co., which is subsidiary to a number of lumber companies operating in that vicinity. The product of the furnace will be car wheel and malleable pig iron; estimated capacity 29,000 tons a year. The

officers of the company are: President Charles H. Schaffer; vice president, Frank B. Baird; secretary and treasurer, Noah W. Gray; manager, Fred Smith.

The Electric Controller & Supply Co. of Cleveland has just shipped the second of two 200-h. p. 220 volt magnetic switch controllers to the Lorain plant of the National Tube Co. They are for the control of the reversing motors driving the tilting tables of the plate mill. These controllers give automatic acceleration, which can be adjusted to the maximum rate consistent with safety to motors and gearing. When reversing from full speed forward to full speed reverse the table is automatically brought to a quick stop and accelerated in reverse direction in the least time interval consistent with safety. The magnetic controller with resistance is placed near the motor, thereby effecting economy in the use of heavy wires. The operating controller, consisting of a small master switch, is conveniently mounted on the roller's pulpit, and since the contacts of this controller carry only very light current it may be operated with exceptional ease. The construction of the magnetic controller, however, is such that no matter how rapidly the operating controller may be reversed, the current flowing to the motor is automatically limited to a safe value. Other recent shipments of controllers of this type have been made to the Carnegie Steel Co., the Lackawanna Steel Co., and the Illinois Steel Co.

The new six story building of the Brown & Sharpe Mfg Co., Providence, R. I., to be used in the erection and shipping of machine tools, is nearing completion. It is an extension of No. 4 building and plans are being made for another story for that building. The new structure is 114 ft. long and 51 ft. wide and covers 6,534 square ft. The frame is of steel, protected from fire by concrete, and the floors are supported independently of the brick walls up to the fifth story.

The large plant of the Liggett Spring & Axle Co., Axleton, Pa., will be enlarged. The addition will cost about $60,000 and 150 men will be put to work. The plant, which was put into operation about one and a half years ago, has been running steadily ever since.

Excavations are being made on the ground recently purchased by the Petroleum Iron Works, Washington, Pa., for a new plant. It has not been definitely decided whether the work of erecting the new buildings will be started immediately or not, but action will be taken at the next meeting of directors.

The Baltimore & Ohio railroad has issued orders to strengthen all the bridges of the Cleveland Terminal & Valley. The work will begin at once and will cost about $115,000.

The Central Pacific railroad will cut a tunnel 33,000 ft. long through the Sierras, at a cost of $12,000,000.

The Pennsylvania program for next year's improvements on the C. A. & C. includes the relaying of rails and the rebuilding of over 40 miles of track.

The Reeves Machine Works, Trenton, N. J., will build an addition at a cost of $8,000.

The Cyclone Wire Fence Co., Toronto, Ont., will erect a one-story temporary addition, and a permanent building will be put up in the spring.

The Hanks Foundry Co., Rome, Ga., is installing machinery and increasing the capacity of its plant. It is erecting a warehouse at a cost of $6,000.

H. E. Thompson is constructing a galvanized iron works plant, 85 x 170 ft., and foundry, 180 x 85 ft., at Louisville, Ky.

The O. R. & N. railroad has awarded the contract for the construction of its new machine shop at Albina, Ore., to George Wakefield for approximately $140,000. The new plant will be 182 x 339 ft. and will be built of brick and steel. When the machinery is installed and new tracks laid nearly $500,000 will have been spent by the company at the Albina shops.

The Philadelphia Iron Works, Philadelphia, have purchased property adjoining their plant and anticipate building an extensive boiler and tank plant in the spring. The company does not contemplate moving its plant to Port Washington as has been stated by newspapers.

Jacob Zehner has purchased a site in York City, Pa., and is erecting a building which will be used as a boiler plant.

The new boiler and machine shop of Broomell, Schmidt & Steacy Co., York City, Pa., will be placed in full operation early in January.

Edwin L. Renzenbrink will rebuild his foundry at Canton, O., which was burned some time ago.

General Industrial Notes:—

The Osawatomie Iron Works Co., Osawatomie, Kas., recently organized, will repair and manufacture well drilling tools and do general machine shop work. Considerable oil and gas have recently been found in the vicinity of Osawatomie and although the field is rather shallow the organizers of the new company believe there is an opportunity for successfully engaging in business. The company bought a building and adapted it for its use. It will have a machine shop 20x60 ft. and blacksmith shop 20x20 ft.

The Iowa Home Safe Co., Marshalltown, Ia., recently organized, will manufacture a small safe suitable for the home. This safe has been made by the Lennox Machine Co., of Marshalltown, but the new concern has secured an option on that company's equipment for manufacturing safes and expects within 90 days to start a new plant. In the meantime the new company has contracted with the Lennox Company to make safes for it.

The Helmbacher Forge & Rolling Mills Co., Madison, Ill., has resumed operations. A force of 400 men, many of whom came from Youngstown and Girard, O., is employed.

The open hearth furnaces of the Minnequa plant of the Colorado Fuel & Iron Co. have resumed operations after a short shut-down, which was due to the necessity of making repairs. The rail mill started on heavy rails last week. Furnace E is being relined. Good progress is being made on the repairs at furnace A. A small force of men is at work at furnace F, the new stack.

The board of trustees of the water works of Muscatine, Ia., have awarded the Dimmick Pipe Co., Birmingham, Ala., a contract for pipes, the bid being about $30,000.

The cash register department of the International Mfg. Co., Columbus, O., formerly the Hallwood Cash Register Co., has been sold to the International Co., a newly organized corporation which will hereafter carry on the business. The recording time lock department is retained by the old company and its officers are looking for a location to which it will be removed and the lock manufactured on a large scale. The capitalization of the new company is $500,000.

Smith & Carpenter, machinists and die makers, Peoria, Ill., have dissolved partnership. Mr. Carpenter has retired and Mr. Smith has organized a new firm under the name of E. M. Smith & Co. to conduct a similar business.

The Worcester Polytechnic Institute, Worcester, Mass., has received important orders for machinery from Brussels, Belgium, and an order for 12 drill presses from London. The shops are working on full time, 50 hours a week.

The Warner furnace at Warner, Tenn., is expected to go in blast in February.

The Sheffield furnace of the Sheffield Coal & Iron Co., Sheffield, Ala., has gone into blast in the past week. Rogers, Brown & Co. are the selling agents.

Foundry No. 2 of the Hodge Mfg. Co., Connellsville, Pa., was placed in operation Nov. 30 for the first time since 1902.

The LaFollette furnace at LaFollette, Tenn., has gone out of commission.

The Jacobs Steel Excavator Co., Amboy, Ill., has elected the following officers: C. C. Jacobs, president; F. N. Vaughan, vice president; W. A. Green, secretary and treasurer. The company was incorporated Oct. 25 with a capital of $50,000, fully paid up.

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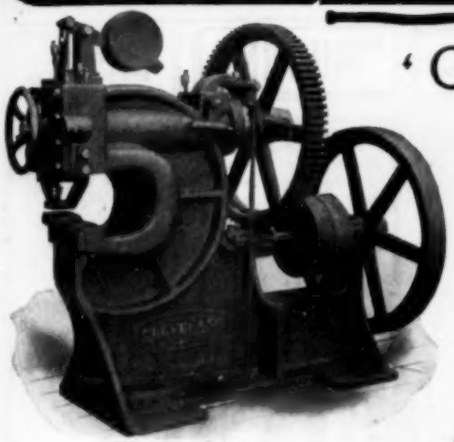

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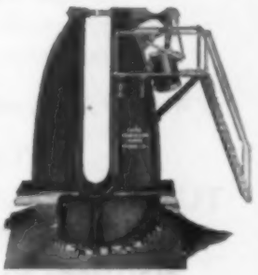

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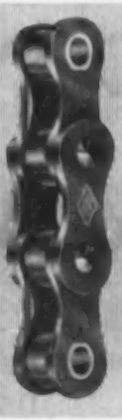

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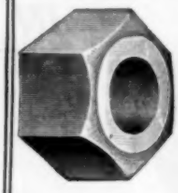

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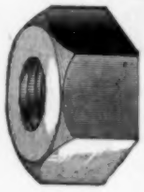

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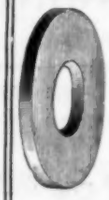

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